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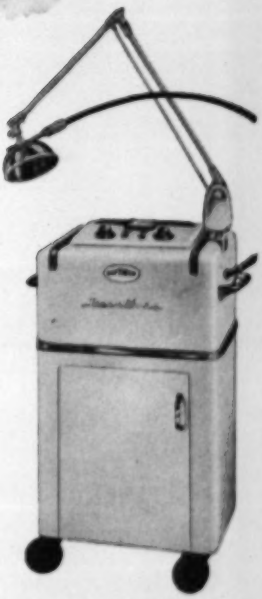

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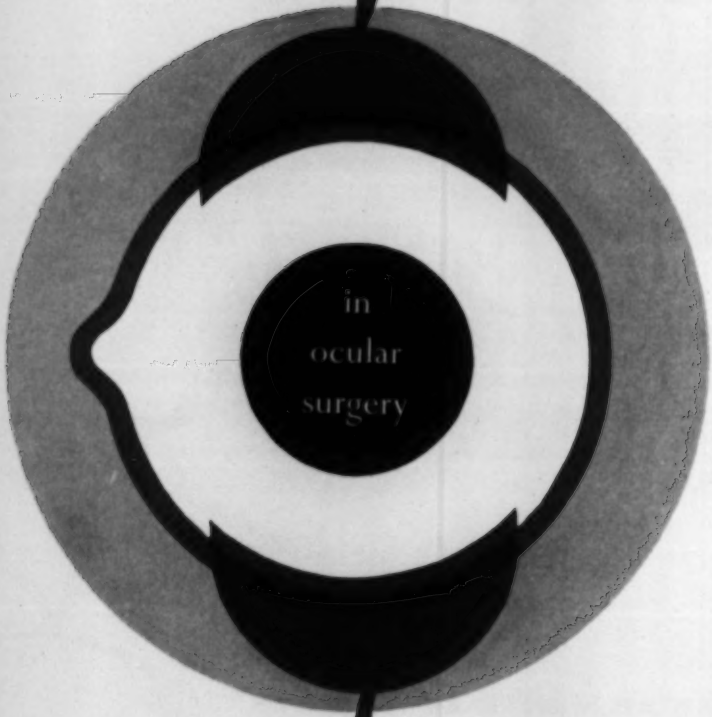

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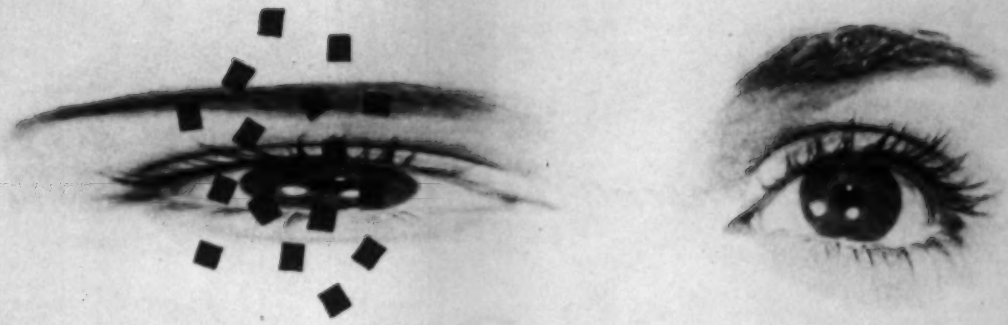

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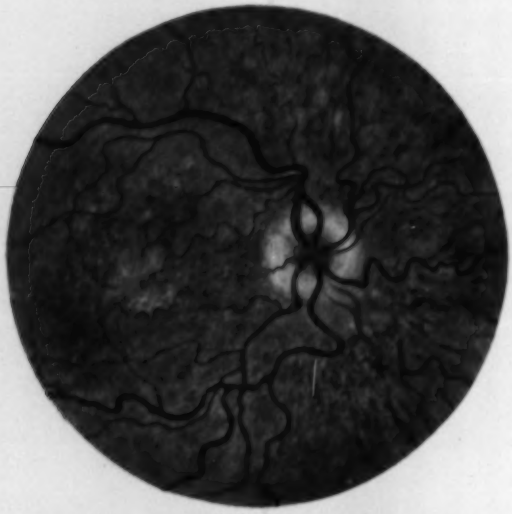

Fig. 1. Right eye of Case 1. Papilledema ex vacuo and macular changes in postoperative hypotony; subretinal pigment lines.

Fig. 2. Left macula of Case 1. Note tongue-shaped macular edema.

Fig. 3. Case 2. Papilledema ex vacuo and macular edema; subretinal pigment lines.

Figs. 1 to 3 (Dellaporta). Fundus changes in postoperative hypotony.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 40 DECEMBER, 1955 NUMBER 6

FUNDUS CHANGES IN POSTOPERATIVE HYPOTONY*

ANGELOS DELLAPORTA, M.D.
Buffalo, New York

The condition of papilledema in ocular hypotony, though not common, has been repeatedly reported. In German-speaking countries the term "Stauungspapille ex vacuo" is used, that is "choked disc ex vacuo." Since this type of papilledema is usually of moderate degree and no retinal hemorrhages occur, the term "papilledema ex vacuo" would be appropriate in order to distinguish clearly this condition from the true papilledema due to increased intracranial pressure.

As the terminology implies, the cause of the papilledema ex vacuo is decreased intraocular pressure, a fact which was established by many clinicopathologic and experimental studies (Elschnig, Stock, E. Fuchs, Kamperstein, Gilbert, Parker, Behr, Inouye, Schieck, Kyrieleis, and others[1]). It occurs usually after antiglaucomatous surgery especially after the various types of fistulizing operations or after perforating eyeball injuries.

Though the papilledema ex vacuo has been verified histologically to be a true edema without inflammatory evidence, one might object that, the eyeball having been perforated, an exogenous toxic agent could not be excluded with certainty as the etiologic factor. However, there are also several cases reported in the literature in which papilledema appeared after hypotony following contusion of the eyeball without perforation (Löhlein, Klauber, von Horvath, Popovic.[2]) In these cases exogenous toxic agents are obviously excluded as etiologic factors. In all cases with or without perforation the papilledema disappears as soon as the tension rises again, proving that the ocular hypotony is the real cause.

A related condition which was lately reported is one in which fine multiple retinal folds occur in ocular hypotony. Five such cases have been reported to date. In four instances (Dellaporta,[3] Renard,[4] Pau,[5]) the retinal folds appeared following antiglaucomatous operations, and in one case following hypotony subsequent to severe contusion of the eyeball (Dellaporta[6]); in four cases including the last one, papilledema ex vacuo was associated with the folds. In discussing the etiology of this condition,[6] it was concluded that the important prerequisites are ocular hypotony preceded by hypertension, and the relatively young age of the patients involved.

CASE REPORTS

The following cases led to the observation of related changes of the fundus in elderly patients.

CASE 1

A 60-year-old woman (H. K., No. 257/46) had an intracapsular cataract extraction with total iridectomy on the left eye in 1939, and in March, 1946, an intracapsular cataract extraction with peripheral iridectomy on the right eye.

Because the tension of both eyes showed readings between 36 to 40 mm. Hg (Schiøtz) and the right optic disc was forming a glaucomatous excavation, a cyclodialysis was performed in April, 1946, on the right eye,

* From the Eye-Bank and Research Laboratory, University of Buffalo Medical School.

and in July, 1946, on the left eye. In both eyes the anterior hyaloid membrane was destroyed and some degenerated fibrillar vitreous entered the anterior chamber through the pupils. These vitreous changes were present since the cataract removal and remained unchanged thereafter. The vision in the right eye was 6/12, J3, and in the left eye 6/8, J1, with corrective lenses. The peripheral fields were normal.

In August, 1946, one month after the last cyclodialysis, both eyes had a tension varying from 8.0 to 13 mm. Hg, and at about that time the discs developed a moderate papilledema without retinal hemorrhages which was attributed to the ocular hypotony. Neurologic examination and X-ray examination of the skull revealed no signs of increased intracranial tension.

In the following months, the vision decreased slightly with persisting hypotony of 9.0 to 10 mm. Hg and was reduced in March, 1947, to 6/24, J4, in the right eye, and to 6/36, J5, in the left eye, with corrective lenses. In November, 1947, seven months later, in addition to the papilledema ex vacuo, two small concentric retinal folds could be recognized around the left macula.

In the following two years the clinical condition of the eyes remained more or less unchanged. The papilledema ex vacuo and the small retinal folds on the left eye were persistently present. In addition fine radial pigment lines appeared gradually on the nasal half of both fundi. There seemed to be macular edema in both eyes but vitreous opacities did not permit an accurate diagnosis. The vision stabilized during that period to 6/18, J3, in the right eye, and 6/24, J3, in the left eye with a tension of about 9.0 mm. Hg.

In November, 1949, the fundi showed the following:

Right eye. The disc had normal color, was distinctly protruding, and had blurred borders. From the nasal half of the disc border very fine pigment lines radiated to the extreme periphery anastomosing extensively on their course and forming a very fine irregular net pattern. The pigment lay under the retinal vessels, was best visible on indirect ophthalmoscopy, and was denser on the inferior nasal quadrant of the fundus. In the macular region a one-disc-diameter, grayish-white, patchlike flat elevation of the retina was visible; its inferior borders were serrated, sharp, and looked steep, while the upper border disappeared gradually into the surrounding retina. One had the impression, especially on indirect illumination with a strong ophthalmoscope light, that there was some fine pigment accumulation under the gray-white spot (fig. 1).

The retinal vessels were tortuous, of normal caliber, and exhibited the crossing phenomenon. The macular veins were corkscrew like. The vessel changes corresponded to those found in essential hypertension.

Left eye. The papilledema and the pigmentation of the fundus nasally to the disc were of the same appearance and degree as in the right eye; also the retinal vessels showed the same changes.

Temporally to the disc the retina was slightly edematous and whitish. The retinal edema terminated in the macula as a tongue-shaped sharply defined, flat, whitish elevation whose borders were lined occasionally by small retinal vessels (fig. 2).

The vision of both eyes was 6/18, J3, with correction; the peripheral fields were normal. No central scotoma could be clearly defined but small objects could not be recognized. Tension was 8.0 to 10 mm. Hg. The blood pressure had gradually risen from 100/80 mm. Hg in 1946 to 210/110 mm. Hg in 1949. These data and the ophthalmoscopic picture were unchanged at the last follow-up examination in February, 1951. Atropine instilled every second day in both eyes over a long period of time did not change the intraocular pressure.

Summary. Severe ocular hypotony after cyclodialysis in two aphakic eyes was followed by papilledema ex vacuo and peculiar macular changes. The macular changes

of the left eye developed from two retinal folds around the macula. The vitreous body was degenerated, with destroyed anterior hyaloid membrane in both eyes.

Case 2

An 82-year-old man (F. D., No. 1006/48) had an intracapsular cataract extraction with total iridectomy and a small loss of vitreous —which was showing fibrillar degeneration —in the right eye in September, 1948. The postoperative course was uneventful but the eye developed a secondary glaucoma with tonometric readings of 40 mm. Hg (Schiøtz) which necessitated a cyclodialysis on November 30, 1948.

The patient was discharged with a normal disc showing physiologic excavation. The vision was +7.0D. sph. ⌒ +4.5D. cyl. ax. 160° = 6/24, J3; and the tension 17 mm. Hg; tension of the left eye was 28 mm. Hg. On January 14, 1949, six weeks later, the tension of the right eye dropped to 11 mm. Hg and remained so.

On February 2, 1949, two and one-half months after the cyclodialysis, the disc showed a moderate papilledema with no hemorrhages. Nasally to the disc fine pigmented lines of the same nature as described in Case 1 were present. In the macular region there was a one and one-third disc-diameter flat, whitish elevation of the retina whose upper and lower borders were sharply defined, the superior being lined by a small retinal vessel. Temporally the whitish elevation disappeared gradually into the normal retina; nasally there were two small horizontal retinal folds which also disappeared gradually into the normal retina. The retinal vessels showed mild arteriosclerosis (fig. 3). Vision was 3/60, J15, with corrective lenses.

The peripheral fields were slightly constricted but because of the advanced age of the patient they could not be properly evaluated. For the same reason the examination of the central scotoma was not conclusive. The blood pressure was 130/80 mm. Hg. These findings remained unchanged until the patient was last seen in January, 1952.

Summary. Severe hypotony after cyclodialysis in an aphakic eye was followed by papilledema ex vacuo and peculiar macular changes. The vitreous body was degenerated with diffuse fine opacities.

Case 3

A 65-year-old woman (A. F., No. 547/49) had an uneventful intracapsular cataract extraction with peripheral iridectomy on the left eye on May 11, 1949. Two weeks later she was discharged with normal clinical findings, except for a restricted flat choroidal detachment inferonasally, and a vision of 6/18, J3, with corrective lenses. The disc was sharply defined with a physiologic excavation, and the retinal vessels were tortuous probably due to the existing blood pressure of 200/80 mm. Hg. Subsequent examinations every two weeks showed an unchanged fundus and vision. On September 5, 1949, the patient came with complaints of blurred vison on the operated eye. There was a slight papilledema and a distinct tongue-shaped edema of the macula similar to that described on the left eye of Case 1 reported in this paper. The eye was very soft on palpation. The vision was 6/18, J3. Atropine was prescribed twice daily.

Four days later the patient came with a tension of 36 mm. Hg (Schiøtz) and vision of 6/12, J2, with correction. The edema of the disc and the macula had disappeared. Atropine was discontinued and in the following weeks the tension stabilized to 25 mm. Hg with vision of 6/8, J1, with corrective lenses.

Summary. Drop in tension of unknown etiology four months after an uneventful cataract extraction caused edema of the disc and macula. Both disappeared four days later when the tension rose after administration of atropine.

Comment

A. The striking common characteristic of the four eyes reported was the postoperative

ocular hypotony of about 8.0 to 10 mm. Hg which was followed by papilledema. The sequence of events, the moderate degree of papilledema, and the absence of retinal hemorrhages and of inflammatory signs warrant the opinion that the observed papilledema was caused by the ocular hypotony. The fact that in the last case it appeared after hypotony but disappeared as soon as the tension rose to 36 mm. proves this opinion to be correct.

The fine radial pigment lines on the temporal half of the fundus as observed in the first three eyes which had fully developed the condition had, possibly, the following mechanism: The protruding nervehead pulled the nerve-fiber layer causing friction between the retina and the pigment epithelium of the retina along the nerve fibers. This friction caused irritation and subsequent gradual increased pigmentation. This hypothesis is supported by the following:

1. The pigment lines were present only on the nasal half of the fundus where the nerve fibers are the most numerous and where the disc swelling is most marked in papilledema.

2. They were more distinct near the optic disc where logically the pull was strongest.

3. The pigment lines followed the general direction and pattern of the nerve fibers in this fundus region. Ophthalmoscopically they were seen distinctly to lie under the retina.

If the above hypothesis is true, the question arises why similar pigment lines are not seen in ordinary choked disc caused by increased intracranial tension, where the protrusion of the nervehead, and therefore the pull, is much stronger. This might be explained by the associated ocular hypotony which allowed in the presented cases the connection between retina and pigment epithelium to become less intimate than normal, and thus facilitated friction between these two membranes.

B. The macular changes were similar in all four eyes. Several weeks after the onset of the ocular hypotony and simultaneously with the papilledema ex vacuo a patchlike or tongue-shaped whitish flat elevation with usually distinct borders appeared in the macular region accompanied by moderate drop of central vision. The macular lesion was often lined by small paramacular vessels and was not greater than one disc diameter though irregular in shape. The macular changes represented, in my opinion, an "edema ex vacuo" of the retina due to ocular hypotony. This opinion is supported by the following:

1. In Case 2 the macular lesion was, on the nasal side, continuous with a retinal edema and small retinal folds. In the left eye of Case 1 the macular lesion developed from two circular retinal folds. In both cases the fine retinal folds were identical with those found in ocular hypotony due to retinal edema.[6]

2. The intimate association with the papilledema ex vacuo: The macular lesion appeared simultaneously with the papilledema, a condition well known to be caused by ocular hypotony.

3. In the last case the macular changes and the papilledema disappeared as soon as the tension rose to 36 mm. Hg. This proves that the ocular hypotony is the causative factor of both the papilledema and the macular lesion, and that the latter represents a pure edema in the beginning stage; an inflammatory lesion could hardly be expected to disappear so quickly. It is reasonable to assume, however, that after long duration the edema undergoes organization as happens in retinal folds in ocular hypotony (Dellaporta[6]), or in the optic nerve after long-standing papilledema. It is not possible to state how much time is needed for the macular edema to become organized but probably not less than several months, possibly a year.

It is obvious that the drop of the central vision was caused by the macular changes because their onset was simultaneous. If the macular edema is of temporary duration as in Case 3, the visual acuity is restored. In

cases in which the macular changes become organized, the impairment of the central vision would probably be permanent.

C. Another common characteristic in the eyes reported was the fact that all were aphakic after successful intracapsular cataract extractions and that the vitreous showed fibrillar degeneration with destroyed anterior hyaloid membrane. Only in the last case which had the hypotony and the fundus changes temporarily were there no vitreous changes.

The small number of the reported cases does not permit any definite conclusion whether the aphakia and the vitreous degeneration were coincidental or of any etiologic significance in regard to the macular changes. From clinical and experimental work,[1] it is well known that neither aphakia nor degenerated vitreous is a prerequisite for the appearance of papilledema ex vacuo. In contrast, there seems to be some etiologic relation between the vitreous degeneration and the macular edema. Theoretically the degenerated vitreous:

1. May sustain the severe hypotony.

2. Does not exert its physiologic cushionlike action on the retina; thus the formation of macular edema is facilitated. In both instances the aphakia increases the described action. This theoretic consideration is supported by the observations of Nicholls.[7] He reported macular edema with drop of central vision in several cases of postoperative aphakia. He attributed the macular edema to vascular dysfunction aggravated by anxiety. After careful study of the history of his cases and especially the clinical signs of spontaneous rupture of the anterior hyaloid membrane or loss of vitreous, I am strongly inclined to suspect that the etiology was sudden ocular hypotony caused by the vitreous membrane rupture.

Considering in general the cases presented in this paper, it might be concluded that severe hypotony in elderly patients with aphakia and vitreous degeneration may cause circumscribed macular edema with reduction of the central vision and associated papilledema ex vacuo. The essential etiologic factor seems to be the ocular hypotony, but aphakia and degeneration of the vitreous (whose normal cushionlike action on the retina is thus reduced) and advanced age seem to play a considerable etiologic role.

Summary

Four eyes of three patients, aged 63 to 82 years, developed severe hypotony after successful intracapsular cataract operations and subsequent cyclodialysis. This was followed by papilledema ex vacuo and circumscribed macular edema which reduced the central vision. Also fine radial subretinal pigment lines appeared in the nasal half of the fundus in the first three cases. The follow-up study of these cases showed that the ocular hypotony was the essential cause of the macular changes but that degenerated vitreous and the advanced age of the patients involved probably played a precipitating role.

University of Buffalo,
Medical School (14).

The reported cases were observed at the First Eye Department of the University of Vienna, Director, Prof. A. Pillat.

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HEMANGIOPERICYTOMA OF THE ORBIT*

SIDNEY A. FOX, M.D.
New York

Hemangiopericytoma of the ocular adnexa is rare. Of the 54 cases appearing in the general medical literature[1-19] only three such cases have been cited. One case, occurring in the lower orbit, was reported by Stout and Murray.[1] Two others were reported by Stout.[7] As far as I have been able to ascertain no report of this tumor has appeared in the ophthalmic literature.

Hemangiopericytoma was first described by Stout and Murray[1] in 1942. They believe that it originates by proliferation of the contractile pericytes. These are cells with long processes which are found in the external capillary wall and which, although they have no myofibrils, are responsible for the changes in the caliber of the capillary lumen. The pericyte was first described by Zimmerman[20] in 1923 and is believed to be a modified smooth muscle cell.

Microscopically the hemangiopericytoma is made up of clumps of epithelial-lined tubes which may contain red blood cells. Endothelial sprouts without lumina are also seen. Both these elements are enclosed in fibers of scanty reticulin around which are seen the rounded or spindle-shaped cells either in single layers or in such numbers as to fill the spaces between vessels completely (fig. 1). There are no elastic fibers. These features are best brought out with silver reticulin stains. A great deal of connective tissue may be present (fig. 2). There is a good deal of cytologic variation in these tumors and the presence of capillaries as well as the formation of connective tissue may vary considerably from one tumor to another.

As Stout[1] points out the endothelium of the capillary is normal hence the tumor is easily differentiated from the hemangioendothelioma. Also hemangiopericytoma varies from the glomus tumor because it lacks the latter's organoid structure. Grossly it is sort of nondescript in appearance and not easily identifiable because it is not always red and may lack other characteristics of vascular tumors.

Clinically hemangiopericytomas are similar to other vascular tumors in that they tend to originate early in life or even before birth. But they may also appear at any age after birth. They may vary in size from small nodules to 12 cm. or more in length. They are slow growing and they have a strong tendency to infiltrate surrounding structures, to recur and even to metastasize occasionally. They may be found in any tissue or in any part of the body although they usually involve the subcutaneous and muscular lay-

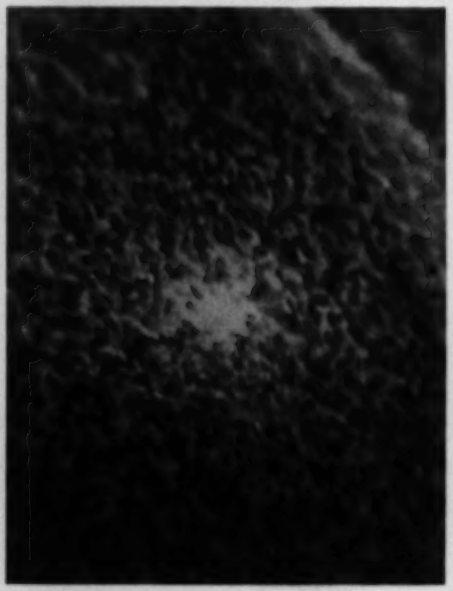

Fig. 1 (Fox). Microscopic section of excised tumor showing characteristic cells of hemangiopericytoma.

* From the Eye Service, Goldwater Memorial Hospital. Presented in part before the New York Society for Clinical Ophthalmology, March 7, 1955.

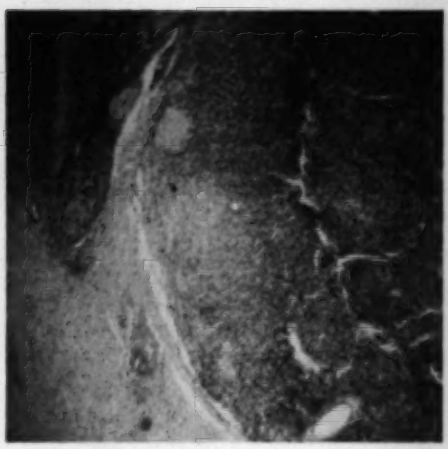

Fig. 2 (Fox). Microscopic section of excised tumor showing cellular and connective tissue elements. Lower magnification.

ers. Diagnosis is best made by microscopic section. The tumor may occur at any decade in life and shows no sex predilection.

Case history

A. T., a 34-year-old white woman, a housewife, was first seen in consultation on December 8, 1953. She gave the following history:

At the age of 14 years, in 1933, a small yellowish conjunctival growth was noted near the right outer canthus. This was cauterized several times without result. In the next four years she had two separate series of "radium needles" which failed to eradicate the growth.

In 1937, at the age of 18 years, the tumor was resected and diagnosed as a xanthoma. It recurred in 1940 at the age of 21 years and was again resected. This time the pathologic diagnosis was benign vascular neurofibroma. In 1950, at the age of 31 years, it recurred and was again resected. The pathologic diagnosis was now benign sclerosing hemangioma. The present recurrence had been noted for the past two months.

On external examination the corrected vision was 20/25 in the right eye and 20/20 in the left. There was a slight pseudoptosis of the right upper lid. The external canthus was rounded and the skin was badly scarred. There was a symblepharon between the external portion of the upper and lower lids and the bulbar conjunctiva. The conjunctiva was also reddened and scarred in this area. A bulge could be seen and a lump could be felt at the external canthus. These were especially noticeable when the patient looked to the left. The media were clear and the fundus appeared normal. Examination of the left eye was entirely negative.

On January 22, 1954, the right orbit was entered at the outer canthus by a transconjunctival approach. The external rectus muscle was secured and cut from its insertion. An amorphous yellowish mass which seemed to be part fibrous tissue and part vascular tissue was found. It was attached to the periosteum of the lateral orbital wall as well as to the sheath of the external rectus muscle. This tissue was stripped from all its attachments and removed including part of the rectus muscle sheath. All adventitious tissue which could be reached was also removed from the depth of the orbit. The rectus muscle was resutured to its insertion with 4-0 chromic catgut and the conjunctiva was closed with black silk. The lids were sutured together and a pressure dressing applied.

The postoperative reaction was rather violent with lid swelling and extreme chemosis. These gradually subsided leaving an exotropia with limitation of internal rotation and a diplopia severe enough to require patching. There was a gradual but constant improvement in the exotropia and diplopia so that by the end of July binocular vision was present everywhere except on looking to the left. This was believed due to a persistent symblepharon which impeded movement to the left and on February 1, 1955, plastic repair of the symblepharon was done. This improved the movement of the eye to the left considerably.

Pathologic report

The pathologic report of one of the re-

sected fragments was as follows:

Macroscopic examination. The specimen is an irregular fragment of tissue which measures 2.5 by 1.0 by 0.4 cm. Its external color is pink to red. The tissue is soft. A few points of hemorrhage can be made out. Other than this it looks like connective tissue and no morphologic details can be made out. A small globular object 0.2 cm. in diameter is found which has a slightly tan color and resembles a lymph node. All of the tissue is taken for section.

Microscopic examination: Sections reveal a well-circumscribed highly cellular tumor (fig. 1) composed of closely packed cells with scanty cytoplasm and regular nuclei embedded in a scanty stroma. Laidlaw stain reveals a very little reticulin in the tumor.

Diagnosis: Hemangiopericytoma of the orbit.

Note. Slides of the previous excision were reviewed and found to be identical with the present lesion. Dr. Stout has seen the slides of the present lesion and concurs in the above diagnosis.

Discussion

Reese[21] states that the vast body of hemangiomas are (1) probably congenital rests and not true tumors; (2) that they are of polymorphous origin containing all the vascular elements within them; and (3) that they are never malignant in the accepted sense of the term. On the other hand the hemangioma, the leiomyoma, and the hemangiopericytoma are (1) true neoplasms and not congenital rests; (2) they are monomorphous in that they derive from one specific cell structure; and (3) they may be locally malignant, may recur, and may even metastasize. Hence they are sometimes called hemangiosarcomas.

There are, of course, vascular tumors which are exceptions to the above. Thus the glomus tumor is monomorphous but is benign. On the other hand the polymorphous racemose angioma may be locally invasive though it shows no tendencies to growth. But by and large the above differentiating characteristics hold true.

It is important therefore to note that the hemangiopericytoma is one of a small group of vascular tumors including the hemangioendothelioma and the leiomyoma (leiomyosarcoma) which unlike other hemangiomas may be malignant. At the very least it shows an aggressive tendency to recur. As noted above the case reported here has already been operated on four times. One of the previously noted orbital tumors had been resected three times. Hence the tremendous clinical importance of this type of tumor. It is fortunate that it is rare.

Summary

A case of hemangiopericytoma of the orbit is reported.

This is one of a small group of rare vascular tumors (including the hemangioendothelioma and the leiomyosarcoma) which can be, and frequently is, malignant.

Its presence should be suspected when any angiomatous neoplasm, however atypical grossly, shows tendencies to aggressive invasion and recurrence.

Diagnosis is best made by microscopic section.

11 East 90th Street (28).

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OXYGEN INHALATION IN RETINAL ARTERIAL OCCLUSION

A PRELIMINARY REPORT

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Observations made in studies on the role of oxygen in retrolental fibroplasia[1,2] raised the possibility that oxygen inhalation may be a beneficial adjunct in the therapy of clinical retinal arterial occlusion. These data are briefly summarized: When young mice, rats, kittens, or puppies were exposed to 80-percent oxygen for four days or longer, the retinal vessels were totally obliterated as seen in flat retinal preparations and in cross sections of India-ink injected specimens. All other vessels of the eye and in particular the choroidal vessels were unaffected. A picture analogous to clinical retinal arterial occlusion was thus produced. In several experiments, the animals were maintained in high concentrations of oxygen continuously for 10 days or longer. In many of these animals complete retinal vessel obliteration persisted until the animals were killed. Although completely avascular for this prolonged period, the retinas appeared normal on cross section. Even the ganglion cells which are farthest removed from the choroid appeared normal (fig. 1).

Apparently oxygen inhalation elevated the choroidal blood oxygen tension increasing the range of diffusion of oxygen to the avascular inner retinal layers. These data suggested that in clinical retinal arterial occlusion in adults, the inhalation of oxygen might diminish the anoxic damage that results from retinal ischemia in these inner layers.

To determine if increased choroidal diffusion actually occurs, the oxygen diffusion across the avascular retina was measured directly with the oxygen electrode. A recording of the oxygen tension at the vitreal surface of the retina was made in five eyes of three anesthetized adult cats using a specially constructed electrode. A platinum electrode insulated by a capillary tube was inserted through a Ziegler-knife scleral incision over

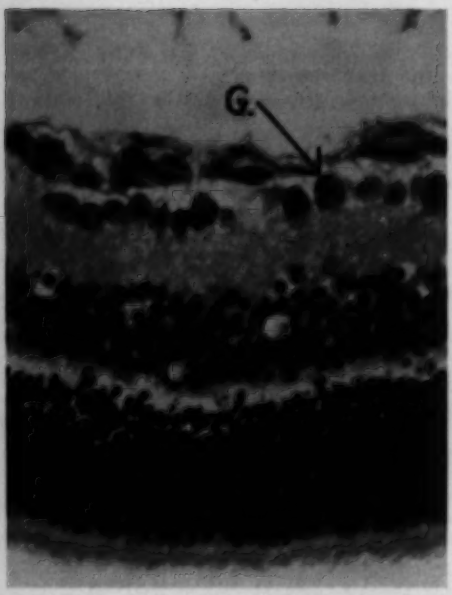

Fig. 1 (Patz). Section of retina of 21-day India-ink injected mouse raised in 70-percent oxygen since birth. Note that there is no ink in the retina. Arrow points to cords of endothelial cells but no canalized vascular channels exist. Although the retina is avascular, the ganglion cells (g) appear normal. (Hematoxylin-eosin, ×400.)

the pars plana of the ciliary body. Under direct ophthalmoscopic vizualization, the electrode was passed across the vitreous to the inner surface of the retina on the opposite side. The oxygen tension was measured and recorded on a continuous recording galvanometer. (Details of this technique will appear in a later report.)

In two eyes the central retinal vessels were occluded by direct coagulation of the optic cup. The oxygen tension at the retinal surface abruptly dropped to near zero. Although retinal blood flow was eliminated, on administration of 100-percent oxygen by tracheal cannula, there was noted a measurable increase in oxygen tension at the inner retinal surface. These preliminary observations with the electrode were essentially a pilot study intended to investigate the feasibility of the technique. Although limited, these observations demonstrated that the range of diffusion of oxygen from the choroid could be extended by the inhalation of oxygen.

A controlled experiment was next performed to determine the effects of oxygen inhalation on experimental retinal arterial occlusion in the adult rat. The rat was chosen because of the similarity between the rat and human retinal circulations. As occurs in the human retina, the inner retinal layers of the rat are nourished by the retinal vessels and the outer layers primarily by the choroid. In both humans and rats, there are two distinct capillary nets in the inner retinal layers with the outer layers being totally devoid of vessels.

Experimental observations

Subjects and Methods

Seventy-two adult white rats were divided into pairs. Under light ether anesthesia, the left eye of each animal was operated. The conjunctiva was dissected and the lateral rectus muscle severed. Under direct visualization under the dissecting microscope, the left central retinal vessels were coagulated by diathermy or severed with a Ziegler knife just posterior to the globe.

One-half of the animals were placed within five minutes into incubators containing 95-percent oxygen, and the other half serving as controls were placed in room air. (Five minutes was the average time required to suture the lids securely to protect the globe.) The animals in each group were killed at two, four, 12, 18, and 48 hours, and eight days after operation. Those animals receiving oxygen for longer than 48 hours were removed to room air for 24 hours on the second, fourth, and sixth day in oxygen to prevent pulmonary oxygen toxicity.

Both eyes were enucleated—the right normal eye serving as a control on technique. The horizontal meridians were labeled with sutures and all eyes after paraffin embedding were sectioned exactly horizontally at six

microns thickness. Routine and special nerve stains were employed. These included Nissl, Gomori's reticulum, Bodian, phosphotungstic acid hematoxylin, periodic-acid Schiff, and hematoxylin and eosin. The amount of retinal edema was quantitated by measuring the thickness of the inner layers with a micrometer scale; ganglion cell and bipolar cell counts per high-power field were recorded.

Results

In the eight-day specimens there was no difference between oxygen treated and controls. In the 48-hour specimens there was equivocal protection of the inner retinal layers by oxygen. In specimens up to 18 hours, however, a varying degree of protection resulted from oxygen administration.

The oxygen-treated animals showed much less edema and coagulation necrosis. Degeneration of the ganglion cells and bipolars was appreciably less in the oxygen-treated animals when compared with their controls in room air (figs. 2 to 4). In no case, however, did the oxygen administration result in total protection of the inner retinal layers as some slight degenerative change was present in all.

Complete details of these data with tables showing a quantitative appraisal of the amount of retinal edema and necrosis, ganglion cell and bipolar cell counts, and the results of special staining techniques are omitted from this preliminary report. They will appear subsequently.

Clinical observations

In two cases of *early* retinal arterial occlusion, oxygen has been administered with an apparent beneficial effect as an adjunct to routine therapy. In two cases first seen two days after occlusion, oxygen therapy had no effect. These cases are briefly summarized:

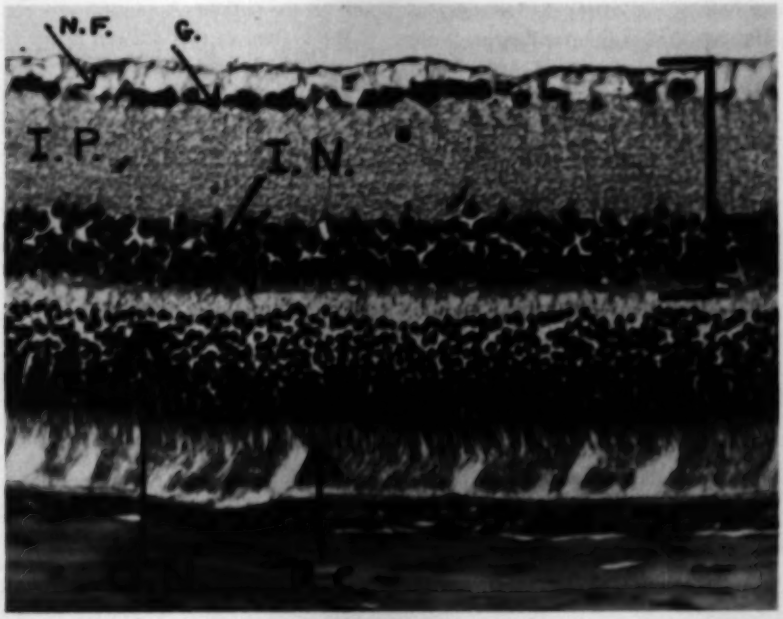

Fig. 2 (Patz). Section of normal retina of one-year-old control rat. Note normal thickness of inner retinal layers (brackets). (NF) Nerve-fiber layer. (g) Ganglion cells. (IP) Inner plexiform layer. (IN) Inner nuclear layer. (ON) Outer nuclear layer. (RC) Rods and cones. (Hematoxylin-eosin, ×400.)

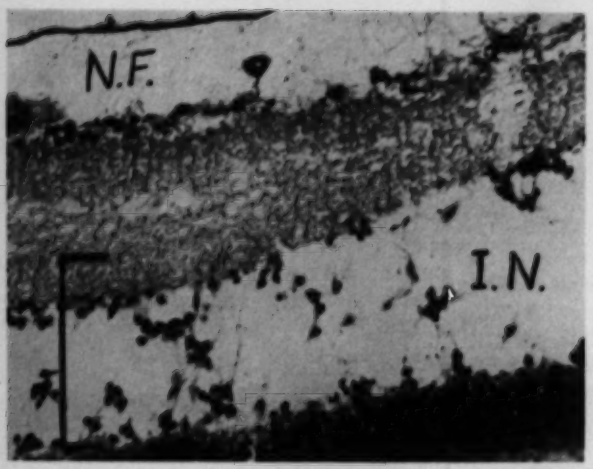

Fig. 3 (Patz). Section of rat retina 18 hours in room air after occlusion of retinal vessels. Note massive edema of nerve fiber layer (NF) and inner nuclear layer (IN). Thickness of inner layers of normal retina (brackets) is shown for comparison. Note coagulation necrosis in inner plexiform layer. Loss of ganglion cell and inner nuclear layer populations is prominent. Note pyknotic nuclei and cell ghosts in these layers. The outer retinal layers are normal. (Hematoxylin-eosin, ×400.)

CASE 1

A 62-year-old white man with a history of hypertension of six years' duration noted a sudden blurring of vision in his left eye. On covering his right eye, he noted that the entire lower half of his left field of vision was blind. He reported for examination four hours later.

The *right* eye was normal with the exception of prominent retinal arteriosclerosis. The visual acuity in the *left* eye was reduced to 4/200. The upper retina showed a diffuse faint pallor and an absolute scotoma involved the lower field of vision including the fixation point. Preparations were made for a cervical sympathetic block.

During this period an oxygen mask was fittd on the patient. A ventura was connected in the system so that oxygen or air could be alternated without the patient's knowledge. The oxygen mask was applied and the ventura set so that the patient was breathing room air for 15 minutes. The absolute lower field defect remained constant. The ventura

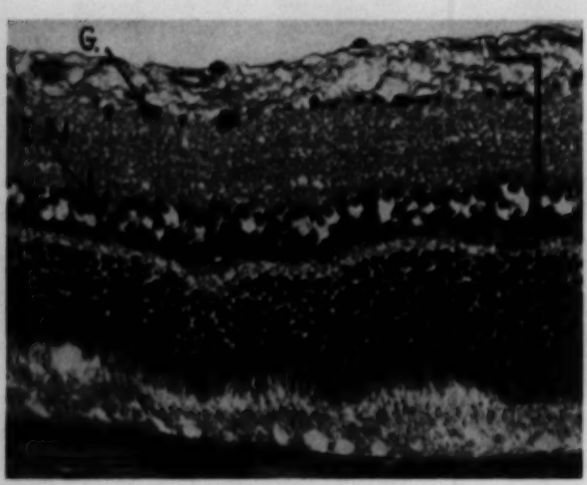

Fig. 4 (Patz). Section of rat retina 18 hours after occlusion of central vessels. The animal was maintained in oxygen during the entire 18-hour period. Compare with animal of Figure 3 which received no oxygen and note much less edema and necrosis of inner retinal layers. Surviving cells in both ganglion and inner nuclear layers greatly outnumber those in the nonoxygenated animal. Brackets show normal thickness of inner retinal layers for comparison. (Hematoxylin and eosin, ×400.)

was then turned to administer pure oxygen.

After three minutes the patient reported, "there is a flickering in the central blind area and I can for the first time see my knees and the floor." A field check showed that the absolute scotoma was now relative and was only detected with a 3/1,000 white target. The visual acuity improved to 20/70. The ventura was then turned to deliver room air. In approximately three minutes the central vision faded, and the lower field of vision disappeared.

Oxygen was started after 15 minutes on air and a similar improvement was noted. On stopping oxygen, the lower field faded (figs. 5A and 5B).

A left sympathetic block was then performed with Xylocaine and massage of the globe was performed. Oxygen inhalation was continued for four hours. On stopping oxygen after four hours, the lower field remained open and central vision stabilized at about 20/70.

The sympathetic block was repeated 24 hours later and the patient was maintained on Priscoline, 25 mg. every four hours, for five days.

The retinal edema in the upper half of the retina gradually subsided. The central vision improved to 20/50. The lower field of vision remained normal. The visual status has remained stable for 14 months with no residual defect detected in the lower field and the central vision remaining at 20/50.

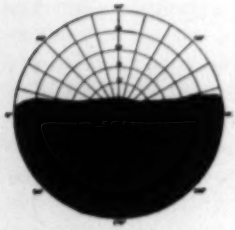

Fig. 5A (Patz). *Case 1.* Tangent screen field prior to oxygen inhalation (5/1,000 white target).

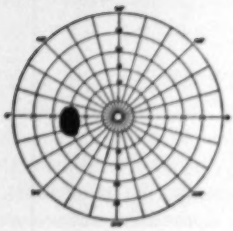

Fig. 5B (Patz). *Case 1.* Tangent screen field 10 minutes after oxygen inhalation (5/1,000 white target).

CASE 2

A 72-year-old white woman with a five-year history of mild hypertension noted the sudden appearance of a "veil" over her left eye while watching television. Examination one hour and 15 minutes later revealed the vision in the left eye to be reduced to no light perception.

Ophthalmoscopic examination showed a faint mild gray haze over the entire retina. There was stasis of the retinal circulation and the classic "cattle car" effect of the blood cells in the vessels was noted. Vision in the *right* eye was normal and the eye-grounds were negative except for moderate hypertensive vascular changes.

A ventura and oxygen mask was used as in the first case. The patient breathed room air through the mask for 10 minutes showing no light perception repeatedly. Without her knowledge, the ventura was turned to deliver 100-percent oxygen. After three minutes, light perception returned in the entire peripheral field. After five minutes, she counted fingers at two feet accurately just temporal to the fixation point. The ventura was turned to deliver air and the vision dropped within one and one-half minutes to bare light perception.

After 10 minutes on air, a change to oxygen elicited the same response as before and, on reverting back to air, the vision again was reduced to light perception only (figs. 6A and 6B).

A cervical sympathetic block with Xylocaine was done and massage of the globe followed. The patient was started on Priscoline 25 mg. every four hours by mouth. Oxygen was administered by mask for three hours. The peripheral field remained full and normal. The central scotoma persisted. After a four-month follow-up the peripheral field

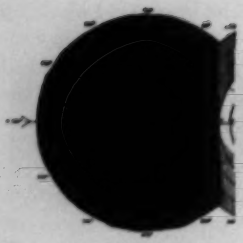

Fig. 6A (Patz). *Case 2.* Visual field, left eye, prior to oxygen inhalation (15/1,000 white target).

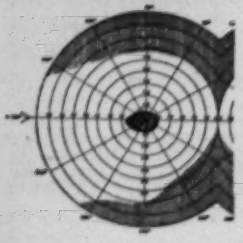

Fig. 6B (Patz). *Case 2.* Visual field, left eye, 10 minutes after oxygen inhalation (15/1,000 white target).

has remained normal. A central scotoma has persisted, however, with vision remaining at 20/200.

Discussion

The use of oxygen therapy in many ischemic processes and especially in acute coronary vessel occlusion is well established in general medicine. In many ocular disorders, Bietti[3] has advocated oxygen therapy to improve general ocular nutrition. In retinal arterial occlusion a singularly favorable situation exists. Here the thin avascular retina lies in direct apposition to the vascular choroid, the circulation of which is intact.

Increasing choroidal oxygen tension by oxygen inhalation permits an extension of the normal range of diffusion of oxygen to reach the avascular inner retinal layers. When the central retinal artery was occluded in rats, apparently an increase in retinal oxygenation via the choroid delayed the onset of irreversible degenerative changes. In a limited clinical trial oxygen inhalation markedly improved the function of surviving retinal elements.

In total retinal arterial occlusion it is apparent that *all* blood-borne constituents directed to the inner retinal layers are depleted. This not only includes oxygen, but glucose and other metabolites. Likewise, the resulting cessation of blood flow should favor an accumulation of carbon dioxide and other breakdown products. Therefore, increasing choroidal oxygen tension to enhance diffusion across the retina aids the ischemic tissue only in its oxygenation without supplying other metabolites. One would anticipate that in total permanent retinal vessel occlusion, in spite of adequate oxygenation, the ischemic adult retina, lacking other metabolites, would ultimately degenerate. These animal occlusion experiments support this premise.

Restitution of retinal blood flow is, therefore, fundamental in the treatment of retinal occlusion. Oxygen inhalation can be considered as an adjunct to oxygenate the ischemic tissues until circulation is restored. It is fortunate, however, that, in many patients, cessation of blood flow is either temporary or partial, as is evidenced by a return of varying levels of vision after occlusion. It is in these patients that oxygen inhalation should be beneficial by reducing the severity of anoxic damage during the temporary ischemia.

In interpreting the animal experiments, it is significant that oxygen therapy was started approximately five minutes after retinal occlusion. Experiments are in progress to determine the maximum time following experimental occlusion at which oxygen inhalation may be expected to have a beneficial effect on the ischemic retina.

There was no difference histologically in the retinal occlusion produced by diathermy coagulation and cutting of the retinal vessels. The rate of appearance of the retinal changes conform closely to those described by Turnbull[4] and confirm his careful studies.

Recommendations

At this preliminary stage, the following recommendations seem justified. When a diagnosis of relatively recent retinal arterial occlusion is made, attempts to re-establish blood flow should be vigorously pursued as

an emergency procedure. The choice of therapy may be one or preferably a combination of some of the following procedures: Cervical sympathetic block, massage of the globe, paracentesis, retrobulbar block and vasodilators. Inhalation of oxygen by a tightly fitting mask or nasal catheter is advised. Oxygen should be administered at a flow rate of at least eight liters per minute during the initial trial.

A working suggestion is that if no appreciable change in the patient's visual acuity or field is noted after 30 minutes, oxygen therapy should be discontinued. If a significant improvement is noted, oxygen inhalation should be continued for about two to four hours along with other measures to reestablish retinal circulation. There need be no concern for pulmonary oxygen toxicity here. However, when oxygen concentrations of over 70 percent are given continuously for 24 hours or longer, pulmonary oxygen toxicity may result.

Cases of retinal occlusion of short duration are seen relatively infrequently by a single investigator. It would be appreciated and extremely helpful in obtaining an adequate clinical appraisal of oxygen inhalation in early occlusion if ophthalmologists giving this a trial would either publish their results or communicate with me.

Summary

1. Previous animal studies on the role of oxygen on the immature retina and experiments cited here on retinal arterial occlusion in the adult rat suggest that oxygen inhalation may be beneficial in cases of early retinal arterial occlusion. A preliminary clinical trial supports these experimental data.

2. The results of the animal experiments are briefly summarized. The responses to oxygen inhalation in four clinical cases are presented.

Addendum

Since this paper was prepared, one additional case of retinal occlusion was seen six hours after the vision blurred. The visual field opened partially after oxygen inhalation. A second case seen four hours after onset of symptoms showed no improvement whatsoever in the visual field or visual acuity after oxygen inhalation.

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Acknowledgements

Mr. Don H. Higginbotham, graduate student in biochemistry, Georgetown University, assisted in the animal experiments and Mrs. Ann Eastham prepared the histologic sections. The preliminary experiments measuring the retinal oxygen tension were done in collaboration with Dr. Martin Larrabee, Department of Biophysics, Johns Hopkins University.

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VISUAL FIELD STUDIES FOLLOWING OCCLUSION OF THE ANTERIOR CHOROIDAL ARTERY*

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In 1925, Foix described the syndrome of the anterior choroidal artery as characterized by contralateral hemiplegia, hemianesthesia, and homonymous hemianopsia. Observations of subsequent authors, some of which included pathologic studies, tended to confirm the syndrome as described by Foix, but revealed that the hemianopsia was not constantly present.

Anatomic studies have since been reported both on normal and pathologic material. Some investigators have assessed the distribution of the artery by post-mortem arterial injection. Others determined, by means of histologic examination, the various structures which they believed to be included, partially or totally, in the area of infarction from occlusion of the anterior choroidal artery.

With regard to the optic pathways (fig. 1) it has been determined that various structures in the pathway may receive blood supply from the anterior choroidal artery, but disagreement has existed about details of the problem. Thus Schiff-Wertheimer found that the most important lesion of anterior choroidal artery thrombosis involved the optic tract; whereas, Abbie, Tarabini, and Poppi maintained that the most significant lesions were in other structures of the visual pathways.

Abbie demonstrated that the principal contribution of the anterior choroidal artery to the visual pathway is its supply of the anterolateral portion of the lateral geniculate body. Abbie and others have pointed out that considerable variation may exist in the territory of distribution of the anterior choroidal artery, but that these variations occur mostly in the so-called "superficial circulation" of the vessel, rather than the deep supply to the globus pallidus. Furthermore, rich anastomosis with branches of other arteries were observed in the superficial circulation, the principal ones being in the lateral geniculate body between the anterior choroidal artery and the posterior cerebral artery.

The results of these investigations have not entirely explained the presence in some cases, as well as the absence in other cases, of hemianopic defects following spontaneous occlusion of the anterior choroidal artery. From a survey of the literature concerned with the syndrome of the anterior choroidal artery, it could be inferred that some symptoms, such as the hemianopic defect, were not actually due to the occlusion of the anterior choroidal artery per se but to generalized cerebral arterial disease and defective collateral circulation.

The present report is concerned with the effect of surgical anterior choroidal artery occlusion on visual pathways in humans. For purposes of this investigation, we have studied the visual field of 12 individuals before and after undergoing the operation of anterior choroidal artery occlusion for alleviation of parkinsonism.

As far as could be determined by clinical investigation, there was no evidence of cerebral or generalized arteriosclerosis in these subjects and the blood-pressure values were within normal limits. The relative absence of visual-field defects following known occlusion of the anterior choroidal artery appears to be worthy of note.

The investigation was carried out in 12 consecutive cases. Both the perimeter and the tangent screen methods were used. For the perimeter a three-mm. white test object

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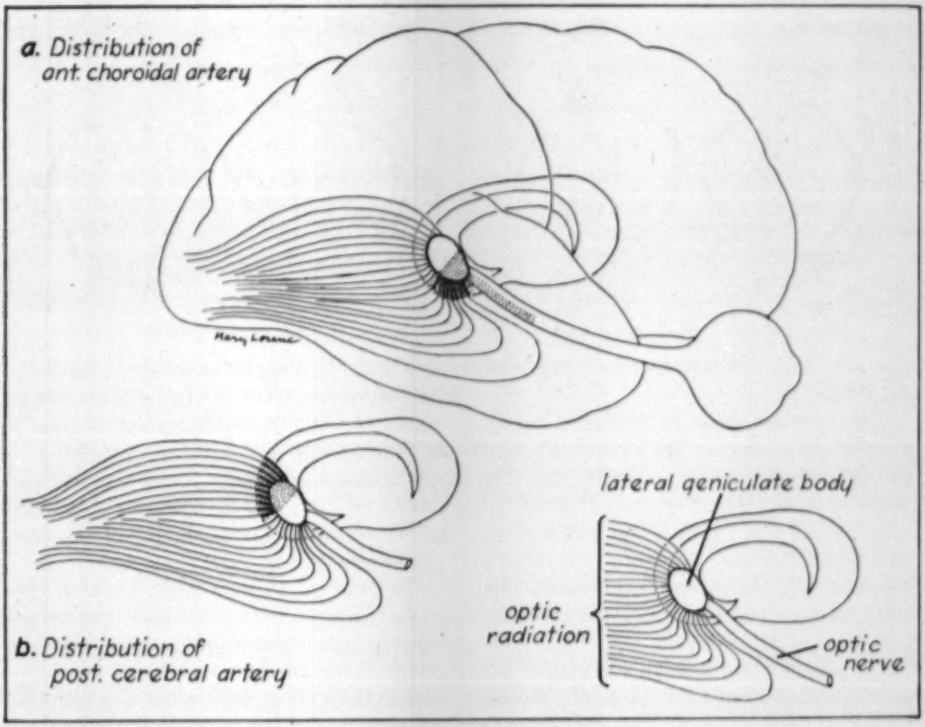

Fig. 1 (Morello and Cooper). The drawing shows the segments of the visual-field pathways supplied by the anterior choroidal artery and the posterior cerebral artery, as defined by anatomic studies. Physiologically, however, the two areas are not well delimited and, in case of occlusion of one of the two vessels, infarction at this point does not always occur.

was used at a distance of 330 mm. A general ophthalmic examination integrated the test in each case.

Case reports

Case 1

John D., a 50-year-old white man, was admitted to the University Hospital on September 8, 1954, and discharged on October 4, 1954.

He had a slight influenza attack during the epidemic of 1918. Five years prior to admission, the patient noticed tremor in the right side of the body. On physical examination, rigidity of the right upper and lower limb with a cogwheel phenomenon in the right arm was observed, as well as severe tremor on that side. There was no motor deficit but severe incapacitation due to the tremor.

On September 13, 1954, an occlusion of the left anterior choroidal artery was performed through a subtemporal approach. Marked alleviation of both tremor and rigidity resulted from the operation. There was no motor weakness postoperatively.

Preoperative perimetric examination of the visual fields showed no abnormalities. The test was repeated 18 days after operation and no defects were found (fig. 2).

Case 2

William J. M., a 51-year-old white man, was admitted to the University Hospital on

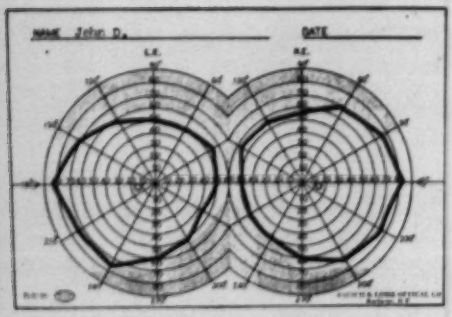

Fig. 2 (Morello and Cooper). Case 1.

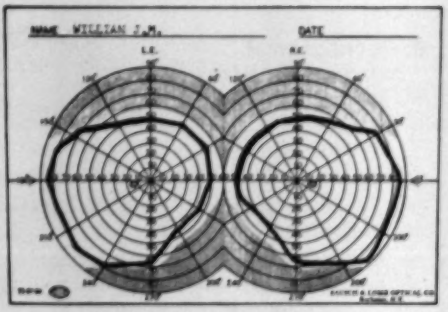

Fig. 3 (Morello and Cooper). Case 2.

July 20, 1953, and discharged on September 15, 1953.

Twelve years prior to admission the patient noted tremor of the right hand which subsequently spread to the right arm. Five years later the tremor appeared on the left side. Stiffness of the neck and both legs was also noted. Recently the tremor extended to the face and the patient experienced difficulty in swallowing. Oculogyric crises occurred about twice a week.

On physical examination the patient presented typical signs of Parkinson's disease: tremor, rigidity, masklike face, shuffling gait.

On July 22, 1953, a right anterior choroidal artery occlusion was performed through a frontal-temporal approach. Complete abolition of rigidity and marked alleviation of tremor on the left followed the operation and six months after the surgical intervention the patient was able to resume his business activity.

Twelve days postoperatively visual-field examination showed no gross abnormalities. Five weeks later no significant abnormalities could be detected (fig. 3).

Case 3

Leon D., a 48-year-old white man, was admitted to the University Hospital on May 24, 1954, and discharged on June 17, 1954.

Seven years prior to admission the patient noted fine tremor involving the left foot, gradually spreading to the entire left side of the body. Within the next few years the tremor became more marked and increasing muscular rigidity manifested itself in the left extremities.

Physical examination revealed severe rest tremor of the left side, involving chiefly the left hand and moderate rigidity of the musculature on the left.

On June 1, 1954, a right anterior choroidal artery occlusion was performed through a subtemporal approach. Complete relief of both tremor and rigidity was obtained and two months after the operation the patient was able to go back to his work as a roofer.

The visual fields were normal preoperatively. Ten days after the operation the examination was repeated and no abnormalities were found to be present (fig. 4).

Case 4

Mary W. P., a 52-year-old white woman, was admitted to the University Hospital on April 14, 1954, and discharged on May 9, 1954.

The patient noted the first symptoms of parkinsonism six years prior to admission. The symptomatology became gradually worse in the last two years and resulted in marked incapacitation.

Physical examination revealed resting tremor of all four limbs and moderate rigidity involving the entire musculature.

On April 20, 1954, a right anterior choroidal artery occlusion was performed

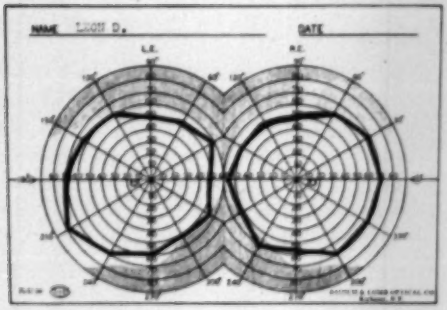

Fig. 4 (Morello and Cooper). Case 3.

through a subtemporal approach. The tremor and the rigidity on the left were absent following operation.

On May 6, 1954, the visual fields were examined and a defect suggesting hemianopsia was found (fig. 5). This was no longer present when, about six weeks later, the examination was repeated (fig. 6).

CASE 5

Mary R., a 31-year-old white woman, was admitted to Bellevue Hospital on April 21, 1954, and discharged on May 30, 1954.

At the age of 10 years, the patient began to complain of weakness in the leg. Within one year the right arm also became involved and at the same time difficulty in speaking was experienced. At the time of the admission to the hospital, the patient complained of stiffness of the right arm and of tremor of the right hand. The latter appeared two years

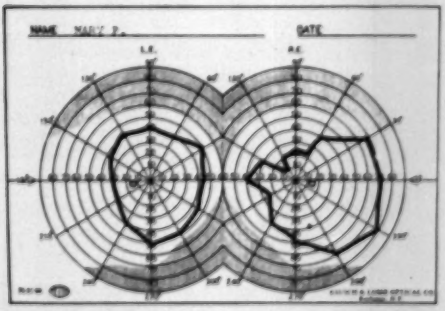

Fig. 5 (Morello and Cooper). Case 4. A defect suggesting hemianopsia was found on May 6, 1954.

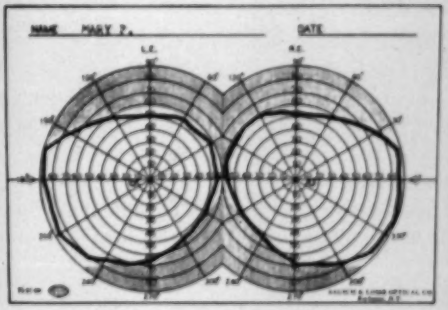

Fig. 6 (Morello and Cooper). Case 4. When the examination was repeated six weeks later, the defect was no longer present.

prior to admission.

Physical examination revealed rigidity of both upper and lower limbs on the right side, coarse tremor of the right hand and almost unintelligible speech.

On May 21, 1954, through a subtemporal approach the left anterior choroidal artery was occluded. Complete relief of the rigidity as well as of the tremor was obtained. The motor weakness which existed preoperative was slightly increased.

The visual fields were found to be normal preoperatively. Postoperatively a right upper quadrant anopsia was found. This was still present six months postoperative (fig. 7).

COMMENT

A definite visual defect persisting into the sixth postoperative month was found only in one instance (case 5). In the series of

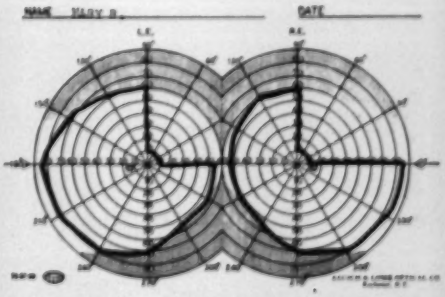

Fig. 7 (Morello and Cooper). Case 5.

cases studied, hemiplegia or hemisensory disturbances were not observed. In most cases a marked and unequivocal change in the tremor and rigidity was produced, testifying to satisfactory occlusion of the deep pallidal branches of the vessel. In several cases postoperative arteriograms were made and compared with the preoperative films in order to add further objective evidence of occlusion of the artery.

From previous anatomic investigations, it has been learned that the only nervous structure which is entirely dependent upon the anterior choroidal artery is the medial portion of the globus pallidus, and that the branches which supply it are the most constant branches of all the branches of the anterior choroidal artery. Other structures, such as the posterior limb of the capsule, the lateral nucleus of the thalamus, the substantia nigra, and particularly the lateral geniculate body receive only part of their blood supply from the anterior choroidal artery and under ordinary circumstances can be adequately supplied by other vessels.

It is for this reason, in our opinion, that relief of tremor and rigidity may result from anterior choroidal artery occlusion without other neurologic signs, although such a result is not invariable. The absence of hemianopsia at times, even in cases in which hemiplegia and hemianesthesia have been reported in spontaneous anterior choroidal artery thrombosis, may be explained on the lesser vulnerability of the optic pathways due to more adequate collateral circulation. Mettler has described the mechanisms of vascular failure in such instances. It is our impression that when a visual field defect occurs following anterior choroidal artery occlusion the lesion extends to optic structures either because of an anomaly of distribution of the artery, or, more likely, because of poor collateral circulation.

In the case of the present series in which a quadrantic anopsia with macular sparing was found to persist six months after the operation, the lesion cannot be placed with certainty. However, the macular sparing and the congruous type of defect strongly favor a lesion of the optic radiations. It would seem unlikely that the possible damage to the temporal lobe is the responsive factor.

It is even more difficult to postulate where the optic pathways were damaged in those cases in which an homonymous hemianopsia has been reported after spontaneous or surgical occlusion of the anterior choroidal artery, in view of the known rich collateral blood supply to the optic tract and lateral geniculate body. According to the present knowledge of the area of distribution of the anterior choroidal artery, and our experience with surgical occlusion of this vessel, a homonymous hemianopsia is not anticipated as a common occurrence after occlusion of the anterior choroidal artery, but will probably occur in cases with systemic arterial disease and defective circulation in the bordering area.

In conclusion we can say that the incidence of visual field defects in cases of surgical occlusion of the anterior choroidal artery is low. When they occur, the reason is likely to be found in defective collateral circulation from the posterior cerebral artery or in anomalies of distribution of the anterior choroidal artery. Overlapping blood supply from different arterial sources in all segments of the visual pathways probably accounts for the low incidence of hemianopsia in this series of cases.

477 First Avenue (16).

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THE SO-CALLED BLINDSPOT MECHANISM*

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In THE AMERICAN JOURNAL OF OPHTHALMOLOGY (December 1954, p. 765) is published the Gifford Lecture delivered by Dr. K. C. Swan on February 5, 1954, and entitled "The blindspot mechanism in strabismus." The author had previously published two other papers on the subject, one in 1947[1] the other in 1948.[2] Evidently he considered this so-called mechanism to be of considerable importance. In his lecture he often implies that the prevention of diplopia by this "mechanism" is important, and repeatedly implies and makes one forthright statement that recognition of this "mechanism" is important with respect to treatment. I shall now critically review his lecture and try to evaluate his so-called blindspot mechanism and its associate, his so-called blindspot syndrome. In doing this I shall also try to correct some misconceptions held by far too many ophthalmologists, and to point out some facts not generally known.

At the beginning of his lecture the author gives an inadequate discussion of diplopia. He seems to be unaware that "suppression" (replacement) is a physiologic process upon which depends prevention of diplopia of all objects not on the horopter. He explains only the diplopia which I[3] have termed disparate diplopia, and here fails even to mention the kind which I have termed corresponding diplopia although it is equally, if not more, important, especially for his subject.

Roughly speaking, disparate diplopia is the seeing of the same object in two different places, corresponding diplopia, the seeing of two different objects in the same place. Those who desire more precise definitions may substitute "directions" for "places" and "direction" for "place." A short term indicating not only diplopia but also rivalry and obscuration of one image by another would be preferable to "corresponding diplopia," but I do not know of one. Later Dr. Swan does describe this kind of diplopia, and terms it "confusion of images," but erroneously implies, by not stating otherwise, that it occurs only in the fixation area.

In this Gifford lecture are many instances of incorrect and of ambiguous wording. I mention them only because they make difficult the interpretation of the statements concerned. Use of the words "utilize" and "mechanism" is incorrect because they actually imply purposeful actions. Thus the expression "utilize the blindspot mechanism" as employed by the author, falsely implies either that the squinter changes the amount of his deviation so as to bring one image of the fixation object upon the blindspot of his deviating eye, or that he has a choice as to whether or not an image upon the optic disc is seen. The author may believe that the first implication is true, but he does not state or present any evidence that it is. Strictly speaking, even the title is incorrectly worded, not only for this reason, but because of the fact that esotropia is part of the definition of the "blindspot mechanism" and therefore the words "in strabismus" in the title are redundant. Another example of incorrect wording is the forthright statement already mentioned, "Patients in whom the blindspot mechanism of the deviating eye definitely and consistently overlies the fixation area merit diagnosis because they require different treatment from the patients with suppression."† To understand this confusing statement I must delete the word "mechanism," and since everyone has "suppression"

* Read before the New England Ophthalmological Society, April 27, 1955.

† Dr. Swan still uses the conventional but misleading terms, "suppression" and "anomalous correspondence," and for the satisfactory term binocular fixation (shortened by me to bifixation) he uses the ambiguous term "fusion." I prefer not to use the term "bifoveal fixation" because it suggests that only the foveas are concerned in the process.

for "patients with suppression" I must substitute "patients in whom disparate diplopia of the fixation object is prevented by suppression." To avoid any misunderstanding, I must say that even when I thus improve the wording of the statement I cannot endorse it, because, as I shall make evident, it is completely untrue.

The statement "diplopia always can be created under ordinary visual conditions by eliminating the deviation with prisms," expresses an impossibility. Here the author is speaking of diplopia only of the fixation object, and only of patients with normal retinal correspondence, and elimination of any deviation when there is such correspondence does not create diplopia of the fixation object but eliminates or prevents it. If, in any case of strabismus, elimination of the deviation does create diplopia of the fixation object it is certain that the patient is manifesting anomalous projection.

It would seem that Dr. Swan did not prove the existence of the so-called blindspot mechanism simply by demonstrating the amount of esotropia. Apparently he relied most on the result obtained by placing a prism of considerable strength before the deviating eye. If this caused diplopia of the fixation object he assumed it to be certain that one of the images had just been on the optic disc of this eye. As a matter of fact, I have found that this procedure may or may not produce such diplopia in cases of strabismus of any degree. Moreover, this is true whether the diplopia is being prevented by "suppression" or by anomalous projection when the prism is placed in front of this eye. Therefore there is considerable doubt in each of his cases as to the existence of the so-called blindspot mechanism, to say nothing of the so-called syndrome.

Dr. Swan and many other writers on the subject of strabismus seem to be unaware that there are squinters who under some conditions manifest normal retinal correspondence, and under other conditions, anomalous projection. Presumable in such cases the squint did not become persistent or frequent, until late in childhood, after the mechanisms for retinal correspondence and bifixation had become well established. In some cases of intermittent squint, the patient manifests normal retinal correspondence while he is bifixating, but anomalous projection when he is squinting. When tested on a haploscopic device, a patient with anomalous projection, may, owing to the abnormal conditions prevailing, give answers that may be falsely interpreted to indicate normal correspondence and even bifixation. Apparently Dr. Swan placed great reliance upon haploscopic devices. No doubt the simple cover test, without and with prisms, would have yielded him highly significant results, but he does not mention its use for any purpose.

For demonstrating anomalous projection when the deviation is not too slight and the visual acuity is normal or sufficiently good in each eye, I have found what I call the A and B test to be the most reliable and also the simplest.[3] Under conditions not otherwise unusual, the image of a letter A, of suitable size, is placed on the fovea of the "straight" eye, and the image of the letter B on the fovea of the other eye. If the patient then sees the two letters separated far apart laterally, and recognizes the letter B he undoubtedly has anomalous projection at the time. If the patient has in some other way already discovered what the letter B is, another letter is substituted for it. It is to be noted that this test is made without the use of a stereoscope, amblyoscope, or any haploscopic device.

To define the blindspot mechanism and the blindspot syndrome Dr. Swan makes the following statements in his summary:

"In an esotropia of 12 to 18 degrees, rays of light from the object fixated by the nondeviating eye fall upon the physiologic blindspot of the deviating eye;* therefore a second image of the object of regard is not

* The light would fall not upon the physiologic, but upon the anatomic blindspot, the optic disc. And it would not fall upon this if it was in a sufficiently unusual position.

observed. This is spoken of as the blindspot mechanism."

"There are some patients with good vision and normal correspondence in whom the blindspot mechanism can be demonstrated to be the sole one which alleviates diplopia. These patients are designated as having the blindspot syndrome."

"Patients with the blindspot syndrome are relatively asymptomatic but may notice occasional diplopia and confusion of images."*

Among the cases in which he found "a blindspot mechanism to be operative," Dr. Swan states that "from the viewpoint of clinical management four groups merit special consideration." Group I was selected on the basis of normal retinal correspondence, Group II on the basis of amblyopia, Group III on the basis of "anomalous correspondence." As to Group IV he says, "This group, which includes patients with the combination of amblyopia and eccentric fixation, will be discussed in a later publication." I surmise that the only important difference between patients in Group II and in Group IV is in the degree of amblyopia, although the author designates Group IV, "Blindspot mechanism with suppression."

The total number of cases comprising the groups is not stated nor is anything said as to the numerical importance of any group,† nor as to ages of patients at onset of squint. Dr. Swan does not explain these omissions, in fact he does not even mention them. Group I is that in which the blindspot mechanism becomes the "blindspot syndrome." The conditions that, according to statements made by the author, must exist here without always causing symptoms, seem impossible. According to the definition there is normal (retinal) correspondence and the sole relief from diplopia is provided by the "blindspot mechanism" of the deviating eye. Since, therefore, there is no "suppression" anywhere the image of the fovea of the deviating eye must conflict with that on the fovea of the fixating eye—corresponding diplopia—and a multiplicity of corresponding and disparate diplopia must always exist throughout the binocular field. That any patient could be to any extent "asymptomatic" under such conditions I am unable to believe. If diplopia is regarded as a symptom, then the patient certainly would have many symptoms.

That in fact no one could be to any extent asymptomatic under such conditions can be shown by a simple experiment in which the specified conditions are reproduced. The experiment can easily be made by anyone with normal vision in each eye, normal retinal correspondence, and bifixation for far and near, but best when there is also presbyopia. A moderately distant view is selected containing a variety of objects and an object of regard whose retinal image is smaller than the optic disc. Bifixation is then *maintained* on the point of a pencil *kept* on the visual line which extends from the right eye to the object. This produces disparate diplopia of the object of regard. By suitably changing the distance of the pencil, the image belonging to the left eye is caused to disappear by being brought upon the optic disc of this eye. Now have been produced the conditions termed by Dr. Swan the "blindspot syndrome." And just as I had anticipated, corresponding diplopia in the fixation area exists, as does a multiplicity of diplopia, both disparate and corresponding, throughout the binocular field. Moreover, because one image of the object of regard was last seen indistinctly and far to the left

* Just what this statement means is open to speculation. Among other things, it could mean that most of these patients are always completely free from diplopia, but an occasional one sometimes has corresponding diplopia in the fixation area and disparate diplopia elsewhere. Or it could mean that the deviation fluctuates so that each patient often does not have the so-called syndrome, and then occasionally has diplopia of the fixation object.

† Dr. Swan does state incidentally, "In the past decade, my colleagues and I at the University of Oregon Medical School have undertaken treatment of more than 200 patients with the blindspot syndrome." This suggests that in the clinic only about 20 patients yearly were designated as having the blindspot syndrome.

of the other image, its disappearance gives no apparent relief from the visual confusion being experienced. It is evident to the observer that satisfying relief from this would require complete replacement ("suppression") of all the images seen by the left eye.

This experiment emphasizes two facts overlooked by Dr. Swan. One is that in a patient with normal retinal correspondence, when the blindspot in the deviating eye prevents disparate diplopia of the fixation object, the blindspot in the other eye prevents disparate diplopia of an object imaged on the fovea of the deviating eye. This prevention is, of course, just as unimportant in one instance as in the other. The second and much more important fact is that under the same conditions, the blindspot of the fixating eye ensures the occurrence of corresponding diplopia in the fixation area, unless this diplopia is prevented by "suppression."

The experiment, of course, can be made in other but less simple ways and equally well by using the left eye for fixation. Anyone who has good control of his convergence need not use the pencil when suitably placed objects are used. Another simple way to make the experiment is to look at a distant view with a prism of 12$^{\Delta}$ before the right eye, and one of 15$^{\Delta}$ before the left, bases in, and note the visual confusion that exists in spite of no diplopia of the fixation object. It is presumed, of course, that the observer has corrected his heterophoria.

Evidently in obtaining Group I, Dr. Swan has selected from his patients supposed to have the "blindspot mechanism," those with good vision in each eye who when tested on a haploscopic device manifested, or seemed to manifest, normal retinal correspondence. These patients he found to be "relatively asymptomatic," no doubt just as would be similar patients without the "blindspot mechanism." Whether or not they had esotropia of exactly 12 degrees to 18 degrees and normal retinal correspondence when being tested, I feel sure that most of them had anomalous projection under usual conditions. I say this because I have found that almost all squinters with good vision in each eye, and old enough to make reliable observations, show anomalous projection when subjected to the A and B test. Of course, when a patient truly has what Dr. Swan calls "confusion of images" he is almost certainly manifesting normal retinal correspondence, but Dr. Swan tells us that in the cases in question this phenomenon occurs only occasionally, and does not tell us whether or not it occurs under natural conditions or only under highly artificial or unusual ones.

From what I have said, and especially from the results of the experiment, it should now be evident that in a patient with normal retinal correspondence and strabismus of any kind or degree, the optic disc, because it is so far from the fovea, and because it is represented by such a relatively small area in the visual field, plays only an insignificant part in preventing diplopia. This means that if a patient with the so-called blindspot mechanism is actually manifesting normal retinal correspondence and is free from diplopia, this freedom must be due to widespread "suppression" (replacement). Therefore the "blindspot mechanism" is not "the sole one which alleviates the diplopia," in fact it plays an insignificant part in doing so and therefore, also, the "blindspot syndrome" as described by Dr. Swan has no existence in fact.

Of course conditions, such as a single plainly visible object in an entirely black field, can be, and for testing purposes, often are artificially produced under which the blindspot of a suitably deviating eye is the sole preventive of diplopia when there is normal retinal correspondence. This is so because disparate diplopia of the fixation object is here the only diplopia to be prevented. These conditions, however, almost never occur naturally, and when they do it would be an amazing coincidence for a patient with just the right kind and just the right amount of strabismus, and with nor-

mal retinal correspondence, to be observing them. And the fact that under these unusual conditions diplopia was prevented by the blindspot, cannot be regarded as of significant importance to the patient, since in a similar patient with only a slightly different amount of esotropia, diplopia would be prevented by replacement ("suppression") or if it was not, the second image would be so far away from the other, and so indistinct, that it would cause the patient no distress.

If, however, when Dr. Swan uses the term diplopia he means diplopia only of the fixation object, his definition of the so-called blindspot syndrome becomes understandable if it is reworded somewhat as follows: There are some patients with the so-called blindspot mechanism who have good vision in each eye and when tested on haploscopic devices show normal retinal correspondence. "These patients are designated (by Dr. Swan) as having the blindspot syndrome." Of course in these as in all other other cases of the so-called blindspot mechanism, "the blindspot mechanism (or rather the blindspot itself) of the deviating eye is the sole one which alleviates diplopia" of the fixation object. It would therefore be redundant to include this fact in the definition. According to this reworded definition the so-called blindspot syndrome may actually exist, at least at times, but when it does it is of insignificant importance. This is true because, as made evident by my experiment, under such conditions the importance of preventing disparate diplopia of the fixation object is insignificant when compared to that of preventing in the fixation area corresponding diplopia, and elsewhere widespread diplopia both corresponding and disparate. Since, according to Dr. Swan, the patients are relatively asymptomatic, all of this really disturbing diplopia must usually be prevented by widespread replacement. Here I may point out again that it is probable that most if not all of the patients supposed by Dr. Swan to have the so-called blindspot syndrome, really have anomalous projection under ordinary conditions, and are therefore then free from diplopia.

I shall now briefly consider the question of the importance of the so-called blindspot mechanism to patients with anomalous projection and without amblyopia, that is to say, to such patients as comprise Dr. Swan's Group III. I have elsewhere pointed out[3] that in cases of anomalous projection "usually in binocular vision each object is consciously seen only from the eye from which it could be the more distinctly seen in monocular vision without change in fixation." By "usually" I meant here "under usual conditions." Since, therefore, under usual conditions in a patient with esotropia of 12 degrees to 18 degrees each blindspot even if it had almost the sensitivity of the fovea of the other eye would take no part in vision, it can be said that the blindspot is of no importance to such a patient. In other words it is neither useful nor harmful to him so far as conscious perception is concerned, and there is no evidence that subconscious perception of retinal images is of any importance to him. The question as to the part the blindspot plays when anomalous projection has become incorrect, for instance as the result of operation, is interesting but too unimportant for me to discuss here.*

Next I shall briefly consider the importance of the so-called blindspot mechanism to patients with amblyopia in the deviating eye, that is, to such patients as comprise Dr. Swan's Group I and IV. Since I have found no squinter with esotropia and amblyopia who, when tested for this, did not have anomalous projection, I presume that almost all of the patients in these two groups had this type of vision. Dr. Swan is silent on this question. If, however, one or more of these patients should have normal retinal correspondence, the blindspot of the deviating eye

* In this discussion I am avoiding the use of the term "replacement" because the process it designates in the case of normal retinal correspondence and that in the case of anomalous projection are undoubtedly dependent upon different mechanisms.

would obviously have the same insignificant importance in the prevention of diplopia it has in the so-called blindspot syndrome. As to the far more numerous cases with amblyopia and anomalous projection, in these also the so-called blindspot mechanism is of insignificant importance, for the same reasons given for such patients without amblyopia.

Dr. Swan states that the blindspot syndrome "may develop in esotropia of paretic origin" but mentions only three cases to support the statement. Probably in many patients with paretic esotropia the image of the object of regard often falls on the blindspot of the deviating eye, but as I have shown experimentally this would give no appreciable relief from the visual confusion and discomfort. Many such patients achieve bifixation by suitably turning their heads and thus changing the amount of deviation, but I have never seen one turn his head to produce a deviation of 15 degrees. Dr. Swan says nothing as to this, but states "I have observed two adults with acquired paresis of one lateral rectus muscle who have utilized the blindspot as a central scotoma when their deviation had become comitant." With a deviation of 12 to 18 degrees it would have been impossible for them not to so "utilize" the blindspot, but the experiment I have described proves that if they had any real relief of their symptoms it was not on this account. The same comments will serve also for the third case Dr. Swan mentions, and for the "children with congenital paresis of vertically acting muscles."

As to treatment, it is in reference to this that Dr. Swan makes his only forthright statement regarding the importance of the so-called blindspot mechanism. This statement of his I have already quoted and commented upon. I have also pointed out that in addition to this he makes many implications that this "mechanism" is of importance as regards treatment. To exemplify these I quote concerning the "syndrome": ". . . if the deviation is only partially corrected so that fusion is not possible under ordinary visual conditions, the deviation tends to increase until the patient again is utilizing the blindspot mechanism and is free of diplopia. When the patients are relieved of diplopia, they also seem to lose the stimulus to fusional movements. This seems the probable reason why the blindspot mechanism tends to stabilize the deviation at about 15 degrees." Here again Dr. Swan implies that the "blindspot mechanism" can relieve the patient of all diplopia. As I have already explained, actually it can relieve him of only an unimportant amount of it. When the deviation returns to 12 degrees to 18 degrees, the patient is again free of all diplopia, not because he has regained the "blindspot mechanism" but because of widespread "suppression." That "the blindspot mechanism tends to stabilize the deviation at 15 degrees," is stated as a fact, but is actually an assumption that can be disproved. And to explain this alleged fact, the author gives a reason he terms probable that actually is worse than impossible, since if valid it would disprove the alleged fact. For although when one image of the fixation object reached the disc, loss of the stimulus of "fusional movements" might theoretically occur to some extent, this loss would be of stimulus to divergence and would therefore tend to enhance the increasing inward deviation, not to check and stabilize it.

Incidentally, the foregoing discussion calls to mind the fact that in a patient with normal retinal correspondence, whose esotropia is decreasing, the decrease, theoretically, might be checked when the deviation reached 12 degrees to 18 degrees and therefore the blindspot blocked out one of the disparate images of the fixation object. Actually, however, the effect on the decrease would be nil because the preceding homonymous disparateness would have been too great to be effective as a stimulus to divergence. If, as I believe, there is no "center" or special mechanism for divergence,[4] it would be better to say here and also in the preceding paragraph "stimulus to the relaxation of convergence."

The decisions as to treatment in any case must of course be influenced by the results to be expected. In spite of Dr. Swan's implications to the contrary it is obvious from what I have just pointed out that it is impossible that these results could depend in the slightest degree upon the fact that before treatment one image of the fixation object was on the optic disc of the deviating eye. The fact that a patient has the so-called blindspot mechanism gives no information as to whether or not he has normal retinal correspondence, or any of the other conditions important in regard to treatment. To ascertain these the same tests must be made as in cases of esotropia of greater or less degree. If normal retinal correspondence or anomalous projection is found the treatment must be based on considerations which, aside from the amount of esotropia, have nothing to do with the fact that in the deviating eye the image of the object of fixation is on the optic disc. These obvious facts make it plainly evident that neither the so-called blindspot syndrome nor the so-called blindspot mechanism is of the slightest importance in regard to treatment.

Since, as I have shown, the so-called blindspot syndrome either has no real existence, or is of insignificant importance, it is not worthy of any name, much less of such an imposing one. As to the name "blindspot mechanism," as used by Dr. Swan, there are several reasons why it is objectionable. As in the case of the syndrome, the fortuitous circumstances that it designates are too unimportant to merit a name. Another reason is that, as previously indicated, there is nothing mechanistic about these circumstances. But the most important reason is that there is an actual mechanism which really deserves this name. For although no visual sensation arises from the optic disc, nevertheless its area of the visual field is not represented in the brain simply as a vacant space. As has long been known, it is filled in so as to correspond to the immediately surrounding field. From a practical standpoint this phenomenon is certainly neither useful nor harmful to an important degree, but from the standpoint of pure science it is of considerable importance and therefore its mechanism is worthy of an appropriate name. A lecture or paper entitled "The true blindspot mechanism in normal and in strabismic vision" could be of considerable scientific value. I feel sure that in normal binocular vision the mechanism of replacement is about the same for the filled in blindspot as for the rest of the binocular field. It is true that the disappearance of an image from consciousness when this disappearance is caused by an optic disc is different from that caused by replacement, because in the latter case the image may still be perceived subconsciously. But it seems to me more than probable that when an optical image is completely upon an optic disc the latter, under suitable conditions, takes the place of this image as a stereoscopic indicator of depth. Moreover, it seems to me at least possible that an optic disc can take the place of a vertically disparate image as a peripheral stimulus toward bifixation.

The foregoing consideration of Dr. Swan's lecture, in the light of some of the established facts concerning strabismus, leads to the inevitable conclusions that the so-called blindspot mechanism and so-called blindspot syndrome are of no significant importance in any respect, of absolutely no importance in respect to treatment, and, to say the least, are unworthy of the names given them.

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ABSOLUTE ELECTRONIC RETINAL STEREOPHOTOGRAPHY*

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The purpose of this paper is to present the result, to date, of an investigation, the primary objective of which has been the design and development of a system of panophthalmic stereophotography. A stereocamera of precision design for photographing the interior and exterior of the human eye is to be considered. Emphasis will be placed upon the significant value of tridimensional photography in the diagnosis, teaching, and case recording of intraocular and extraocular diseases which exhibit stereopathologic features. At this time details will be given regarding the application of the new unit to intraocular or retinal stereophotography.

HISTORY OF STEREOPHOTOGRAPHY

For the past four decades ever since Thorner,[1] using an ingenious laboratory instrument of his own design, presented the first relative or successive exposure stereoscopic photograph of the retina in 1909, numerous investigators have attempted to develop a practical method for photographing the ocular fundus in stereoscopic relief. In 1927, Metzger,[2] using the first clinically practical monocular retinal camera initially described by Nordenson in 1915 and made available about 1925, presented a technique of relative or successive exposure retinal stereophotography.

The subject of relative retinal stereophotography has been well documented by Metzger's and the 10 articles which followed. These were contributed by Wessely,[3] Nordenson,[4] Stock,[5] Bedell,[6] and Von der Heydt[7] all of whom wrote in the year 1927. The following year Pavia[8] continued the subject, while in 1929 Bedell[9] and Zamenoff[10] each presented material. The two final papers to appear on the subject were contributed by Bedell[11] in 1935 and by Pavia[12] in 1936.

The paucity of references to projectable colored stereoretinograms, the absence of retinal stereophotography at ophthalmic conventions, and the nonavailability of a retinal stereocamera is considerable supportive evidence for the semisuccessful nature of the efforts made by the pioneer investigators, and points to the absence of practical progress made to date in this particular field.

When each component of a stereogram is exposed successively or nonsimultaneously the method is called relative stereophotography. The application of successive exposure stereography is strictly limited by the dictums of stereophotographic technique to inanimate objects. In my opinion the early retinal stereophotographers failed to produce a simple accurate method of tridimensional photography of the retina because they ignored this important rule when they applied relative stereography to the animate human eye.

Relative stereophotography is directly dependent upon an interexposure shift, the step responsible for parallax or the slight dissimilarity required between the views composing the stereogram. In the case of retinal stereophotography this shift is accomplished by a change in the position of the camera or in the fixing eye. Following the shift a readjustment in focus and illumination is required after which the second exposure is made which completes the stereoscopic picture.

The interexposure shift introduces several undesirable factors which together pre-

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vent a practical technique of retinal stereophotography. The first weakness is in the shift per se, for, although its extent may be constant, the effective magnitude can by no means be relied upon to be so since the eye is subject to motion following the first exposure. This is of considerable import for it is obvious that inter- and intra-case comparisons cannot be considered reliable unless the effect of the shift factor is the same at all times. The surgeon-filmer may actually obtain misinformation from such comparisons where the relative technique has been employed. In addition prolonged fixation characterizes the relative method and this leads to fixation fatigue which in turn causes global motion, a most undesirable complication. These features of the relative method, coupled with the problematic status of duplicating focus and illumination in the second photograph, work against obtaining consistently good retinal stereograms. The elimination of the cause of these weaknesses, namely the interexposure shift, will prevent them and help to promote a sound practical technique of retinal stereography. The elimination is accomplished through the employment of absolute or simultaneous exposure stereoretinography.

The electronic stereocamera

The prototype of the photographic instrument used for taking absolute colored retinal stereograms was presented to the specialty in 1952 during the annual meeting of the American Academy of Ophthalmology and Otolaryngology.[13] With this early version it was possible to demonstrate that absolute retinal stereophotography could be made a practical reality. The basic unit of the electronic pilot model to be described now consists of: The camera proper, the illuminating system, and the control gear, or power supply. These three components are shown in Figure 1, and will now be considered in turn.

The camera proper is composed of two main parts:

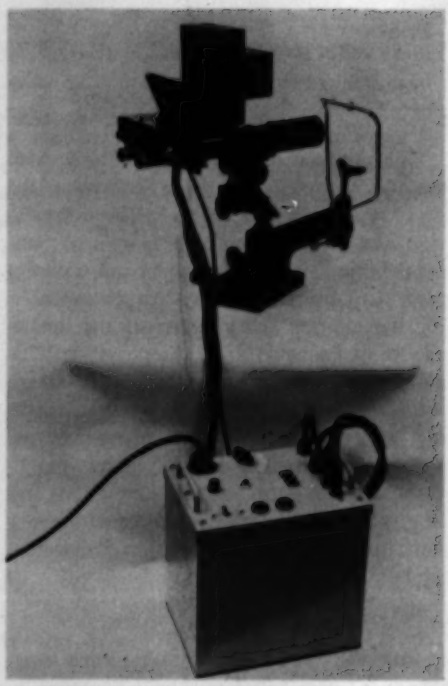

Fig. 1 (Norton). Panophthalmic stereocamera, lamp housing, and control gear.

1. Two light conducting channels. These consist of a small adapter box, a modified ocular tube, and the conventional Huygenian eyepiece, successively, from the binocular eyepiece housing outward. Binocular focusing is preserved in that the two light conducting channels may be freely moved toward or away from each other in the accustomed manner.

2. The camera body. This is located above the binocular eyepiece housing as shown. Two first surface mirrors, attached to a rod running the length of the camera body, are lowered to a 45-degree position inside the adapter boxes by turning a trigger knob located at either end of the camera. Prior to lowering the mirrors, the light conducting channels must be 63 mm. apart. This position is assured by the stop-lock seen in the photograph. For reasons to be made clear later in this report, a 35-mm. "pack-type" camera was adapted.

The source of illumination represents the second part of the basic unit. Two approaches to the question of an adequate illuminating source were followed.

The first was to utilize a lamp wherein the exposure time was varied while the intrinsic brightness remained essentially constant. The F.A.-5 Xenon flash tube, originally introduced by Hansell and Beeson,[14] was modified to apply to retinal stereophotography. The lamp is mounted in a vertical position its light rays being made to fall upon the slant side of a right-angle prism located above the condenser lens of the ophthalmoscope. In this way the light beam is redirected to a second prism located below the condenser lens from which it follows the well-known light path through the ophthalmoscope. A miniature fan, not included by the British group, incorporated into the lamp housing minimizes the heat factor. Flash tube, prism, and fan comprise an over-all unit contained within the housing shown in Figure 1. The housing and contents merely slip into position after all parts of the conventional ophthalmoscope lamp housing have been unscrewed and removed. Initial alignment of the lamp is sufficient for future photography.

The second line of approach to the illuminating system was to utilize a lamp having a constant exposure time but a variable intrinsic brilliance. To satisfy this set of conditions a miniature 1,000 watt-second quartz electronic tube fixed at a flash duration of 0.004 sec., a speed 10 times faster than the fastest or down component of the blink reflex as recorded by Hartridge,[15] was utilized. The tube was mounted above a 150-watt projector-type tungsten lamp which was used for focusing, the actual exposure being made with the flash tube. The dual nature of this light source eliminates the annoying effect of multiple short stroboscopic flashes during the pre-exposure or focusing period, and in so doing prolongs the life of the discharge tube. Setting the flash duration at 0.004 sec., rather than 0.0001 sec. as recorded by Rucker and Ogle,[16] avoids the complications of underexposure and film reciprocity failure thus eliminating the necessity for special processing procedures in that routine commercial processing schedules may be adhered to, a most practical consideration. The lamp housing for this light source, not shown in Figure 1, is somewhat smaller than the Xenon tube housing.

The respective control units for the lamps described constitute the third part of the basic unit. Although detailed circuitry is not within the realm of this paper, a few major points will be covered. Experience showed that the control gear for the Xenon tube as offered by the British group could be made more practical as to size and ease of operation.

Originally the main arc of the flash tube was started via an auxiliary electrode through the intermittent closing and opening of a start switch. When it was found that this operation could be difficult and time consuming, a control system was developed through which the main arc could be struck directly.

Opening and closing the start switch was replaced by a single start button which is held down steadily for a very few seconds until the arc is struck. Using this modification the arc, when cold, is nearly as easy to start as a tungsten lamp and just as easy to start when slightly warm. The closed Xenon arc is operated from the conventional 110 volt 60 CPS wall supply at a current of 10 amperes and a potential of 15 volts.

During the focusing period the tube glows as a 150 watt light of a remarkably stable nature, compared to an open carbon arc. When the mirrors reach the lower end of their excursion, the lamp is pulsed at 5,000 watts the discharge lasting 0.06, 0.10, 0.20, or 0.50 sec. depending upon the setting previously made on the panel of the power unit. Varying the duration of the pulse provides the amount of light required properly to expose a highly, moderately, or slightly pigmented fundus. The approximate color tem-

perature at the time of the pulse is 5,500 Kelvin degrees, a rating compatible for use with daylight-type color films.

The Xenon control unit is shown in Figure 1 and is considerably smaller and more compact than units recently described for controlling this lamp. The control gear for the quartz electronic discharge tube consists of a variable resistance for the tungsten component and a system of condensers for the discharge tube. Both are contained in a single unit similar in size to the Xenon power unit illustrated. The desired light intensity required for photographing the particular fundus involved is not governed by varying the duration of the discharge as in the case of the Xenon tube, but rather by altering the intrinsic brightness of the discharge. This is set on the control panel and can be varied from 500 to 750 to 1,000 watt-seconds of energy per flash. The estimated color temperature involved at the time of discharge is 5,900-6,500 degrees Kelvin. At the time of writing the 1,000 watt-second quartz tube and control gear are experimental.

At first glance it may not be fully appreciated that the two high-intensity lighting systems described have made it possible to simplify greatly the mechanical design of the stereocamera over that of former planar retinal cameras. This can best be indicated by mentioning two very costly and intricate features embodied in retinal cameras of the past. First, the new camera has no shutter and secondly a neutral density filter mechanism is not necessary. Both of these mechanical parts require delicate synchronizations. Their elimination is due primarily to the rapid speed with which the exposure can be made and to the fact that photophobia is not encountered while the lamps are being used for focusing.

Absolute stereoretinographic technique

The technique of stereography differs in one important respect from that of stereo-ophthalmoscopy in that greater attention must be paid to fine detail when a stereophotograph is contemplated. It not infrequently happens that the desired information may be obtained during stereo-ophthalmoscopy irrespective of whether areas of excessive or insufficient light have been removed from the retinal field. In the case of photography such highlight and shadow areas are absolutely contraindicated and must be removed from the field before making the exposure. So far as possible, identical retinal focus and illumination should prevail in each field as seen through the oculars prior to stereophotography. This condition plus being sure that the area of maximum pathology is in the most critical possible focus, regardless of whether surrounding areas are maximally acute, are absolute prerequisites to obtaining good retinal stereograms. When dealing with retinal pathology involving a great level difference, it is better to keep the summit of the elevation in acute focus while sacrificing criticalness at the base rather than vice versa. Fortunately lack of acuteness in either or both planar stereographic components does not always mean the structures involved will lack sharpness when viewed stereoscopically. On the contrary, they may improve considerably in criticalness. Nordenson called attention to this phenomenon years ago, while reference has been made to it more recently, the theory of replacement having been offered as the explanation.

There are five adjustment knobs on the modern binocular ophthalmoscope. Two move the instrument in an anterior-posterior direction, one acts in a vertical direction, another controls the chinrest. The fifth moves the ophthalmoscope in a lateral direction. Once the patient, with a fully mydriatic pupil, is comfortably seated before the ophthalmoscope preparatory to a binocular fundus examination, the following steps must be taken to obtain an absolute stereoretinogram:

1. By adjusting the elevating knob of the ophthalmoscope, the light beam, as viewed

by the examiner's naked eye, is made to fall upon the iris just below the lower border of the pupil.

2. While still viewing with the unaided eye, an acute circle of light is made to fall on the iris by adjusting the gross anterior-posterior knob.

3. Next, while viewing binocularly through the instrument it is slowly elevated until a full stereoscopic view of the fundus is appreciated.

4. The fine anterior-posterior adjustment is made while critically viewing a detail in the area of maximum pathology.

5. The lateral adjustment is now made which equalizes the focus seen through each ocular lens.

In the majority of cases these adjustments suffice before releasing the electronic camera trigger. On occasion it has been found beneficial to refine further the focus through the lateral adjustment knob while alternatingly closing each eye and viewing monocularly to be sure each view shows approximately the same degree of focus.

It should be made clear that the routine steps just enumerated apply to surgeons having an interpupillary distance of about 63 mm. In the case of individuals having a distance considerably over or under this figure binocular focusing is still possible, but if chosen over monocular focusing an additional or sixth step is required prior to making the exposure. In such a case the two eyepieces must be moved closer together or farther apart, as the case may be, until they become fixed at 63 mm. by the stop lock. It is then only necessary to make a final adjustment by turning the fine focus knob while viewing each field monocularly before making the exposure. This additional step may be avoided providing the surgeon-filmer is content to set the interocular distance at 63 mm. and then focus by monocular alteration. Equalization in focus between the two components of the stereoscopic pair should again be emphasized. This is achieved through slow slight turns of the lateral adjustment knob. This maneuver should be the very last consideration before taking the picture.

The stereofilm: Processing-mounting, viewing-projecting

The absolute stereoretinograms appearing in this article were taken with a stereo unit very similar to the one shown in Figure 1. They have been reproduced from black and white shiny prints made from black and white negatives which were in turn copied from the original color stereotransparencies. The stereoscopic retinal pair is exposed simultaneously on a piece of color film measuring 100 by 35 mm. which is contained in a 35-mm. film pack. This is shown in Figure 1 with the mask pulled out and ready for the exposure. Corresponding points in each stereo component are located 63 mm. apart and each retinal photo has a magnification of about ×15 and a diameter of 20 mm. This diameter fills a standard commercial stereomount frame measuring 24 by 23 mm. while still permitting a narrow strip of unexposed film to surround the stereopicture, a most desirable situation particularly when stereoprojection is contemplated.

At the moment it is felt that Ektachrome film is the film of choice in retinal stereophotography. Two varieties are available for use with the lamps described earlier. Using the original daylight-type Ektachrome (E-1) adequate exposure is obtained at 0.1 sec. while 0.05 sec. suffices when the new daylight-type Ektachrome (E-2 or E-135) having an A.S.A. exposure index of 32 is used. These exposure times are based on heavily pigmented fundi. Since exposure is adequate and film reciprocity failure does not enter into the picture, standard commercial processing schedules are applicable, impractical processing modifications thus being avoided. A second fast color film, Anscochrome 135 (daylight), was released just prior to completion of this paper. Studies indicate fine grain, high resolving power, and proper reproduction of fundus color fidelity characterize this film. A combined

processing and mounting service is offered whereby the retinal stereograms are mounted behind glass and returned in a remarkably short time.

The adaption of a 35-mm. "pack-type" camera coupled with the use of Ektachrome film has a fourfold purpose. The use of individual color film strips rather than roll film minimizes the time element between exposure and study of the mounted stereotransparency since individual stereograms are ready for immediate postexposure processing. The film can be processed by most commercial laboratories, the photographic department of modern medical centers, and by the individual, so inclined, in his home laboratory. It is believed that the above combination prevents the lengthy time element heretofore involved and in so doing eliminates a significant obstruction to the more routine use of photography in the specialty.

Another advantage is that the film strip containing the stereo pair can be mounted as a unit without having first to separate each component by cutting then mounting separately. The significance of this mounting technique lies in the strict control it offers over the horizontal and vertical alignment of the stereoscopic components, an extremely important consideration particularly in projection stereography.

Lastly the use of film strips rather than the roll system makes possible a permanent individual transparency labelling system in that data pertinent to each stereogram can be recorded in the 45 mm. interpicture space at the time of exposure. This alleviates the necessity for keeping data record books from which information must be transferred to returned slides, a most time-consuming task. Details of the data system will be given in a future communication.

Since the mounted retinal stereotransparencies adhere to commercial standards as to style and size, they may be viewed using instruments available on the market. Experience has shown that Ektachrome stereotransparencies, having a resolving power of 56 lines per mm., may be projected to large screen sizes without apparent loss of detail.

The description of a method for viewing published stereograms, and which practicalizes their use as an adjunct to the text of publications concerned with stereopathologic features now follows. The lower edge of a small pocket mirror, the type commonly found in a woman's handbag, is placed on the page midway between the stereoscopic pair. The mirror is held by the right hand with the reflecting surface facing toward the right. The observer positions his head directly above the two photographs. Next, the mirror is raised straight upward until its silvered surface lies against the right side of the observer's nose and its upper corners fit firmly against the superior and inferior orbital margins. The lower edge should still be held directly over an imaginary vertical line drawn midway between the two pictures. Supporting the head and mirror on the elbow of the mirror arm places the observer's eyes at approximately the proper distance from the printed stereoscopic pair. With both eyes open the physician now looks toward the left hand picture only. The bottom edge of the mirror is slowly moved back and forth until it is noted that the right component of the pair moves from right to left and superimposes upon its fellow. At this point the mirror is held steady and the vivid relief of retinal stereopathology is comfortably and easily appreciated free from the strain of excessive convergence and accommodation.

Examination of the stereograms included in this communication will show that the right-hand picture must be printed backward in order to make the above viewing method possible.

Viewing Figure 2 will reveal an extreme example of intraocular stereopathology in the left eye. A white fibrous band is shown passing between the nervehead behind and the posterior surface of the crystalline lens anteriorly. Further scrutiny will show a loop

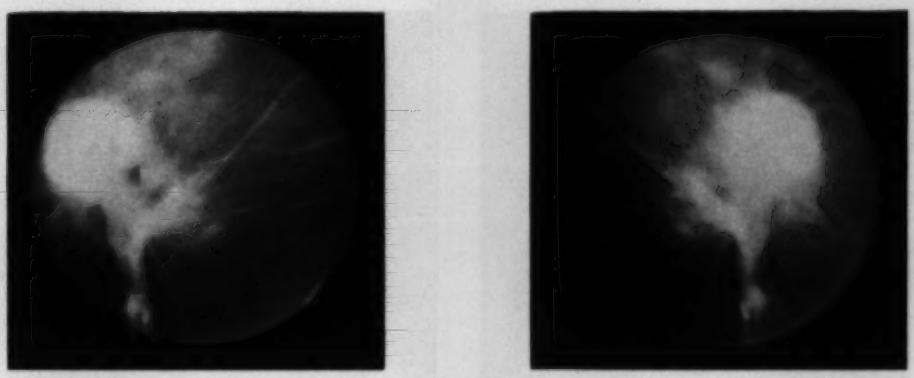

Fig. 2 (Norton). Retinal stereogram, showing white fibrous band passing between left optic disc behind and posterior surface of lens anteriorly. Trauma and congenital influences were revealed in the history.

of retinal vessels to be pulled forward with retina included in the vascular loop. Extensive vessel sheathing is also present. Global contusion and congenital influence were revealed in the history of this case.

The stereopathology in Figure 3 is represented by a hugh retinal excavation located down and temporally from the right optic disc. When fused heavily pigmented overhanging edges are noted, and the retinal cavity is seen to extend almost through to the choroidal system posteriorly. Titers were consistently positive for toxoplasmosis in this case.

Another form of stereo-excavation is seen in Figure 4 which depicts a complete cupping of the nervehead resulting from ocular hypertension. The vignetting seen at the periphery of these photographs no longer appears in more recent stereograms. The reflex seen in some has been minimized or eliminated through the use of a red India ink control spot measuring three mm. in diameter placed at the center of the posterior surface of the objective lens. Red has been found to be more efficacious than black since it blends better with the natural color of the fundus.

Last steps concerned with the application of the new ophthalmic stereocamera to ex-

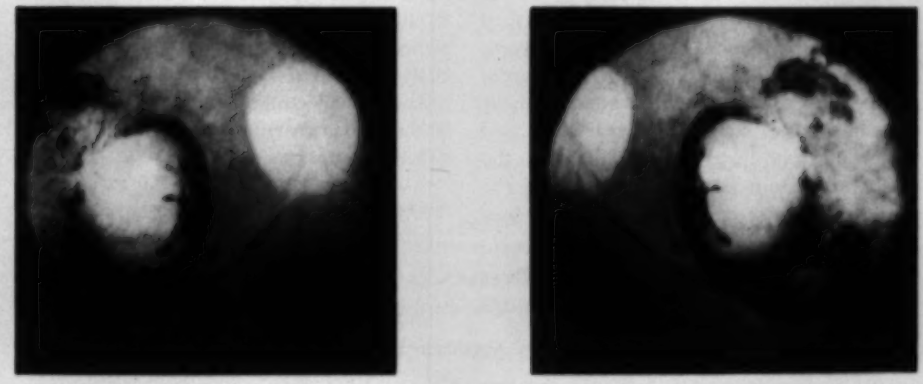

Fig. 3 (Norton). Retinal stereogram, revealing a large retinal excavation located down and temporally from the right optic disc. Titers were consistently positive for toxoplasmosis.

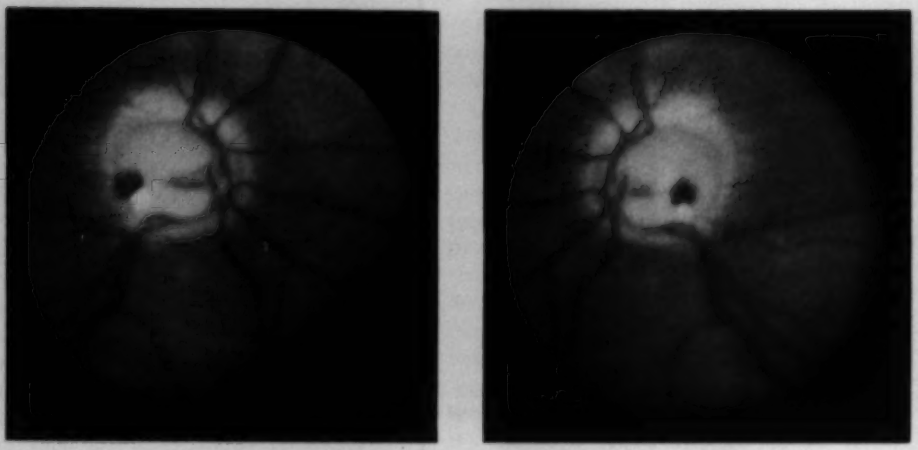

Fig. 4 (Norton). Retinal stereogram, showing complete stereopathologic cupping of the right optic disc in a case of ocular hypertension.

ternal eye and anterior segment stereophotography as well as to stereophotography of gross and microscopic ophthalmic specimens are being completed at the time of writing. Details will be offered at a future date.

Summary

A stereocamera of precision design capable of taking retinal as well as external colored stereophotographs of the human eye has been presented. The operation of the camera is based upon the technique of simultaneous exposure of the stereoscopic pair which produces an absolute stereogram. A simplified method for viewing published stereograms produced from basic stereotransparencies is introduced. The stereograms conform to standard commercial dimensions which makes them viewable and projectable with instruments available on the market. The unit is an integral part of the modern binocular ophthalmoscope, the identity of which is preserved as an examining and diagnostic instrument, and this permanency eliminates the usual time required for setting up equipment to photograph the external and/or internal eye.

Conclusions

1. The routine use of stereophotography in ophthalmology has been made practical through the development of a photographic instrument based upon the principles of absolute stereography.

2. The introduction of an instrument capable of photographing the internal and external eye in color and the third dimension places ophthalmic photography on a maximally sound basis.

3. A valuable new adjunct has been added to the armamentarium used for instructing in ophthalmoscopy.

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CRYSTALS IN THE ANTERIOR CHAMBER*

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The occurrence of crystals in the anterior chamber is far from common and there is very little written about them in the literature, although crystals have often been described occurring in the cornea and in the lens.

LITERATURE

The presence of crystals in the living eye was first reported by Parfait-Landrau[1] in 1828. Three years later Schmidt[2] observed a shower of silver- and gold-dust gush forth when he opened the anterior lens capsule of an eye that had been blind for years. This dust was said to consist of minute crystals of cholesterol. Since this time several authors have had the opportunity to examine these crystals microscopically and have claimed that they are composed of cholesterol.

Gautier[3] (1848) recorded the case of a man whose traumatic cataract of 16 years' duration suddenly disappeared, and at the same time the anterior chamber became full of golden crystals. He supposed that the lens had been merely a mass of crystals enclosed within the capsule.

Windsor[4] (1858) saw crystals in the anterior chamber of a man, aged 27 years, who five days previously had been struck in the right eye by a piece of stone: "There was some blood at the inferior part of the anterior chamber, but the greatest part of this chamber was occupied by a shining metallic like substance, in the form of a granular disintegrated mass. The substance seemed to extend from nearly the whole inner surface of the cornea backward toward the iris which was thus concealed by it." He ascribed the appearance to broken-up lens passing forward after the blow, mixed with blood from the same cause.

Neeper[5] reported a case of a woman, aged 49 years, with a family history of myopia and cataracts. A right cataract extraction performed five years previously was accom-

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panied by a large hemorrhage from the iris and subsequent blindness. She now complained of pain in this eye for the first time and examination revealed an irregularly shaped mass of "cholesterol" crystals occupying the lower fourth of the anterior chamber. The tension was low and there was no red reflex.

Juler[6] had a patient, aged 18 years, who five years previously had injured his right eye in an air-gun accident. The lens was opaque and a needling resulted in 20/20 minus vision. The fundus showed a brilliant group of colored crystals close around the macula and also scattered around the periphery. Similar bodies were also seen throughout the vitreous, on the iris, on the back of the cornea, and floating in the aqueous.

Lloyd[7] reported a case of synchysis scintillans of the anterior chamber in an eye that had suffered a penetrating injury 20 years previously. The eye had been struck again recently causing redness and pain in it. On examination there was a hypermature cataract with a ruptured capsule and a fluid vitreous.

In a case described by Koby,[8] the crystals were enclosed in a gelatinous mass which was "shown" to be vitreous, and microscopic examination "showed" the crystals to be cholesterol. He saw this case 15 years following a perforating injury by an iron fragment.

In 1937, Bonaccolto[9] and Wendell Hughes[10] each reported a case of synchysis scintillans in the anterior chamber with secondary glaucoma. Hughes did a paracentesis in his case and "identified" cholesterol, which he thought came from degenerated vitreous.

Knapp[11] reported a case of rupture of the lens capsule in a hypermature cataract causing secondary glaucoma. It was that of a 67-year-old white woman who had been known to have a mature cataract for 23 years, with no light perception. The pupil was filled with a white mass extending into the anterior chamber, and slitlamp examination revealed many shining crystals floating in the aqueous.

Danielson[12] saw a 21-year-old man with an anterior chamber solid with an iridescent mass of crystals. Five years previously a piece of copper had been removed from the sclera near the ciliary body, and this was accompanied by a slight loss of vitreous. The lens at that time did not appear to have been injured; there was a little blood in the vitreous but the fundus was normal. A few days later there was a vitreous hemorrhage with subsequent retinitis proliferans. Now the patient complained of an inflamed eye. There was no light perception, the tension was normal, and the lens was opaque. The eye was later enucleated. I am indebted to the Armed Forces Institute of Pathology for the section and report. These eyes rarely come to enucleation, because the crystals either cause no symptoms or they are removed in the process of relieving a secondary glaucoma. Cholesterol slits are visible near the angle of the anterior chamber (fig. 1). They appear as whetstone-shaped empty spaces which they occupied prior to the fixation process. The pathology report is interesting:

GROSS. There is a cone-shaped detachment of the retina. A small ossified mass is evident at the optic disc on the nasal side. The iris is bound down to the lens. A cyclitic membrane is present. Glistening gelatinous exudate fills the deep anterior chamber and subretinal space (fig. 2).

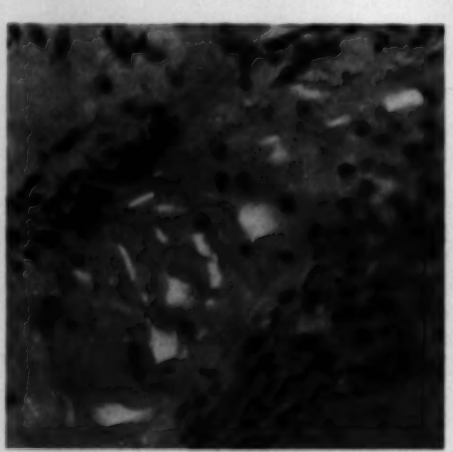


Fig. 1 (Gruber). Cholesterol slits in the angle of the anterior chamber.

Fig. 2 (Gruber). Gross section of eye shown in Figure 1.

MICROSCOPIC. The lens and detached retina are adherent to a scar of a perforating wound of the sclera and orbicularis. The lens is subluxated and degenerated. It contains calcium deposits. There is an anterior capsular cataract. Serous exudate containing a few mononuclear and polymorphonuclear wandering cells and cholesterin slits fills the anterior chamber. The iris is edematous. Chronic inflammatory cells are scattered throughout the uveal tract. There are drusen on Bruch's membrane. The detached retina has undergone gliosis and cystoid degeneration.

There is a plastic cyclitic membrane. (H. C. Wilder.)

Several papers have been published recently on glaucoma secondary to rupture of the lens capsule. One of the most recent, by Hubbersty and Gourlay,[13] was very interesting in that three out of their four cases showed crystals in the anterior chamber, and in all three they claim to have identified cholesterol crystals microscopically following paracentesis. It is also of interest to note that all their cases had senile cataracts, and in one of them two small rents were seen in the anterior lens capsule through which lens matter was escaping.

Calcium crystals may also be found in the anterior chamber as shown by Samuels and Fuchs[14] (fig. 3). These appeared to be yellowish white clinically and had been considered to be cholesterol.

Fig. 3 (Gruber). Calcium needles in atrophic eye after cataract extraction (Samuels and Fuchs[14]).

CASE REPORTS

I should like to report six cases which showed crystals in the anterior chamber. The first two were patients of Dr. G. Bonaccolto, who has kindly given me permission to report them. In the first case, the particles were globular rather than crystal-like, but Dr. Bonaccolto is of the opinion that this represents an early stage of crystalline formation.

CASE 1

A woman aged 74 years, came in complaining of blindness in the right eye for many years. No previous history was obtainable.

On examination, vision in the right eye was light perception with good projection, and in the left eye 20/70 with correction.

The left eye was normal other than for an immature cataract. The right eye showed

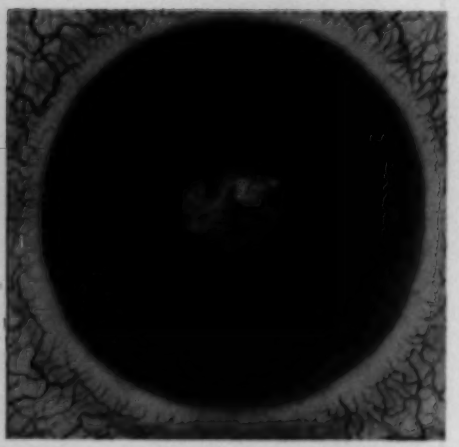


Fig. 4 (Gruber). Multicolored particles in the anterior chamber (Case 1).

ciliary injection, bedewing of the corneal epithelium, and an early Fuchs' dystrophy. The tension was high. There were no deposits on the endothelium. The pupil was 3.5 mm. and irregular. The aqueous was filled with numerous, very small, globular, hyaline particles. The lens showed a mature cataract and the anterior capsule appeared intact.

Slitlamp examination revealed myriads of colors as the light struck the particles (figs. 4 and 5). The iris had lost its normal pattern and showed some congestion. There were posterior synechias nasally but there was a free space between the pupil border and the anterior lens capsule where the lens was subluxated. This space was also filled with these small globules.

There was not enough reaction to account for these particles on an inflammatory basis, and Dr. Bonaccolto believes that what was seen represented degenerated vitreous, which was not completely fluid because the particles were suspended and did not settle. Any further increase in degeneration and fluidity would result in the particles becoming crystal-like. In the vitreous cavity this would represent an asteroid hyalitis progressing to a synchysis scintillans.

Case 2

A man aged 30 years, who had always been nearsighted was first seen in May, 1946. He had been operated on 10 weeks previously for an old retinal detachment in his right eye. The vision was hand movements only. The cornea, anterior chamber, and iris were normal, and the lens was clear. The vitreous was cloudy, but an extensive retinal detachment could be made out. Transillumination was negative and no further surgery was advised. The left eye was also myopic and had a fluid vitreous.

He was subsequently seen again in 1949 at which time the condition of the eye was just the same, except the vision had been reduced to light perception only.

He was next seen in September, 1950, and this time the eye was red, the cornea clear, and the anterior chamber was deep. There were no deposits on Descemet's membrane. The tension was low.

Slitlamp examination showed the anterior chamber to be occupied by many transparent crystal-like particles which reflected myriads of colors in the light. Many were accumulated

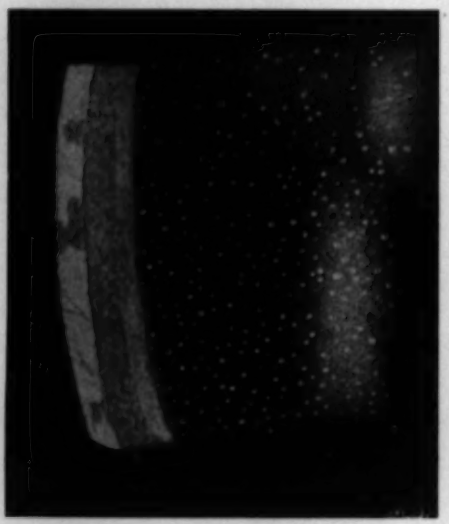


Fig. 5 (Gruber). Slitlamp appearance of the particles seen in Case 1.

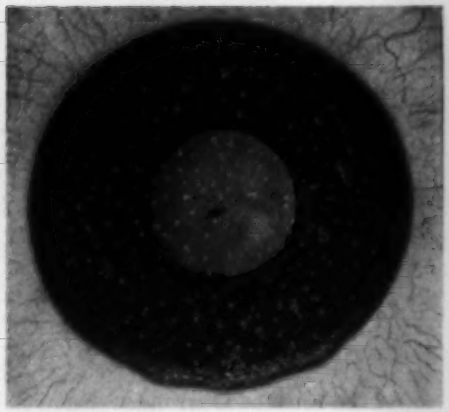


Fig. 6 (Gruber). Crystal-like particles in the anterior chamber (Case 2).

in the lower part of the chamber, forming thick hypopyonlike material (figs. 6 and 7). There was one posterior synechia inferiorly. The iris had lost its normal structure, and there was a free space temporally between the iris and the lens, which showed that the lens was subluxated. The lens itself showed a mature soft cataract.

In this case the vitreous must have been completely fluid because the particles were able to settle.

CASE 3

This was the most striking of my cases. It was that of a 26-year-old white man who was admitted to the New York Hospital originally in 1943, when he was 15 years of

Fig. 7 (Gruber). Slitlamp appearance of the particles seen in Case 2.

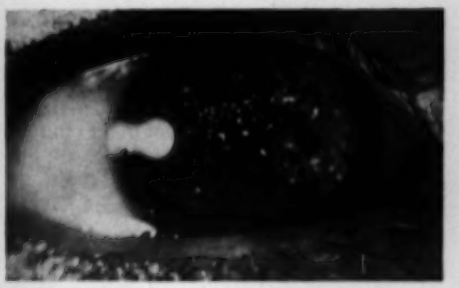


Fig. 8 (Gruber). Crystals in the anterior chamber (Case 3).

age, with a retinal detachment in his right eye. One year prior to this he had been struck in the eye by a rubber ball. A diathermy re-attachment operation was performed, and this had to be repeated about eight months later when the retina became detached again. A cataract was noticed one year later.

For the last few months he had noticed that this eye sparkled, especially when the light struck it. At times this was more obvious than at others. On examination the right eye had no light perception. The pupil was fixed at 2.5 mm. The anterior chamber was deep and full of shimmering, highly iridescent, needle-shaped crystals which moved about freely in the aqueous in whirl-like fashion (fig. 8). As the eye moved the crystals were shaken up so that there was a continuous scintillation. The crystals followed the path of the usual convection currents seen in an eye.

There was also a pseudohypopyon of this material at the bottom of the chamber and, on moving his eyes this was all stirred up, which accounted for the eye sparkling more at some times than at others. When the eye was still the crystals would again settle to the bottom of the chamber.

The lens was densely opaque, and as far as could be seen the capsule was intact. The tension was 17 mm. Hg (Schiøtz). The pupil dilated poorly but enough to see that the lens was subluxated downward, and the crystals could be seen going behind the iris

in the upper nasal aspect. The left eye was entirely normal.

The only indication for removing the crystals at this time would be for cosmetic purposes, and he has been told that even then the crystals might return.

CASE 4

A 75-year-old white man, who had been known to have had a mature cataract in his left eye for at least the last 19 years, with no known etiologic factor, entered complaining of sudden onset of severe pain in this eye.

On examination he had light perception only. There was marked conjunctival and circumcorneal injection. The cornea was edematous from a tension of 80 mm. Hg (Schiøtz). There were no keratic precipitates. The anterior chamber, which was of normal depth, was loaded with crystals which appeared multicolored as the light struck them. The lens was densely opaque but no detail could be made out.

It was assumed that this was a glaucoma secondary to small breaks in the capsule of a mature cataract, with the liberation of lens material into the anterior chamber. The chamber was irrigated and then the cataract was removed. The postoperative course was quite uneventful.

The tension has remained normal, the anterior chamber is clear, the fundus is normal, and there is no evidence of past detachment of the retina. The vitreous face is intact, and there is no synchysis scintillans present. The vision with correction is 20/40.

CASE 5

A 71-year-old white woman, who was known to have had a cataract in her left eye for the past eight years with no useful vision, entered complaining that for the last month she had been having recurrent attacks of pain in this eye. The doctor who first saw her diagnosed iritis and prescribed atropine drops. When first seen she had light perception only, the pupil was 3.5 mm. and fixed, and the globe was congested.

Slitlamp examination revealed a diffuse corneal edema, a few keratic precipitates, a moderate flare, and the anterior chamber was seen to contain just a few small crystals. The anterior chamber was deep and there were extensive posterior synechias. There was a dense white hypermature cataract, and scattered over the anterior capsule were many small crystals also.

The intraocular pressure was high so she was given 500 mg. of Diamox in an effort to reduce it. This had no appreciable effect after four hours, so she was taken to the operating room and the cataract was removed. Cholesterol was not discovered in the small amount of aqueous that was examined. The convalescence was uneventful.

The vision is correctible to 20/40 minus, there is some early macular degeneration, but otherwise the fundus is normal and there is no evidence of synchysis scintillans or previous detachment of the retina. The tension has remained at a normal level.

CASE 6

A 53-year-old white woman came in complaining of pain in the left eye for two days. Ten years previously she had had a retinal detachment in the right eye which had undergone unsuccessful surgery. Three years ago she had had a retinal detachment in the left eye. At that time the right eye revealed a hypermature cataract and the left eye an immature cataract. Operation for the detachment in the left eye was again unsuccessful and following it only a red reflex was seen.

On examination she had no light perception in either eye. The left globe was very red and tender. The cornea was edematous and there were many keratic precipitates.

On clearing the cornea with anhydrous glycerine, there were seen to be white flakes and crystals adherent to the corneal endothelium, and there were also many of these floating in the anterior chamber. There was a marked aqueous flare and a small hypopyon below. The lens was dense white. The tension was 67 mm. Hg (Schiøtz). The right

eye showed a clear cornea and anterior chamber and the lens was dense white with a wrinkled capsule. The eye was enucleated and, on sectioning, the anterior chamber was seen to contain an albuminous exudate with cholesterol slits within it. The retina was completely detached.

Discussion

There seems to be no doubt, from reviewing the literature, that these crystals are almost always composed of cholesterol. However, none of the authors mention how they have determined this fact, except to say that the crystals were identified microscopically. They appear as highly iridescent, needlelike crystals, and are usually freely suspended in the lower part of the anterior chamber, but may be attached to the lens capsule, iris, or corneal endothelium. They may occur as a consequence of traumatic, inflammatory, vascular, degenerative, and neoplastic disease. Under vascular diseases I would include hemorrhages from any cause, hypertensive states, and diabetes.

The crystals are often well tolerated in the anterior chamber but they can set up a violent iridocyclitis from irritation, or secondary glaucoma from blockage of the angle and normal filtration channels. It may be very difficult to distinguish keratic precipitates from deposits of lens material on the back of the cornea.

Very often there is a history of previous injury, with a recent slight trauma which may invoke the condition. The previous injury causes a cataract formation and possibly degenerated fluid vitreous, while the recent injury may dislocate the lens and allow the vitreous to come forward into the anterior chamber, or rupture the lens capsule allowing degenerated lens material into the anterior chamber.

Table 1 summarizes previous reports in the literature and also the present cases. Out of the total of 21 cases, it is interesting to see that at least 15 had cataracts, and four had known retinal detachments. The intraocular pressure was increased in nine cases, and there had been a previous injury in eight cases and possibly more. Cholesterol was identified microscopically in six cases.

Origin of the crystals

1. Lens
2. Vitreous-via choroidoretinal diseases
3. Subretinal fluid in retinal detachments
4. Iridocyclitis exudate
5. Hyphema
6. Hypopyon

In certain cases of iridocyclitis, chemical changes in the exudate may manufacture crystals in the anterior chamber. They have also been described occurring in a hyphema or hypopyon. However, the great majority take origin from cataractous lenses or diseased retinas through the medium of a fluid vitreous.

Lens origin

Sgrosso[15] demonstrated that the normal lens contains cholesterol, and that this content increases 10 times when it becomes cataractous. Tyrosine crystals can also occur in the lens. Crystals can be found at times in a relatively clear sclerotic lens (fig. 9), though they are more commonly found in mature and hypermature cataracts, also complicated and traumatic cataracts. They have also been seen in normal lenses of children. Crystals are a feature in many familial cataracts, and in the cataracts of mongolism, myotonia atrophica, tetany, and thyroid deficiency.

Lens opacities develop with the accumulation of intercellular fluid and with alterations in the cytoplasmic proteins, resulting in the precipitation of some of the proteins. As opacification progresses, substances other than proteins may precipitate or crystallize out, such as cholesterol and other lipids.

Hypermaturity of a cataract is characterized by the elimination of degenerated lens products, and subsequent contraction and secondary organization of the cortical remains. This may cause calcareous deposits

TABLE 1

SURVEY OF CASES IN THE LITERATURE AND OF CASES PRESENTED HEREIN

Author	Year	Age	Sex	Previous Injury	Previous Detachment	Vision	Tension	Lens	Cholesterol Identified	Impression
Schmidt	1831		F			Blind		Cataract	Yes	
Gautier	1848		M	Yes				Cataract		Lens a mass of crystals
Windsor	1858	27	M	Hit five days prior		Poor				Mixture of lens material and blood
Hartridge	1895	24	M	Old penetrating				Cataract		
Neeper	1908	49	F			Blind	Low	Extracted 6 years prior with large hemorrhage from iris		
Juler	1921	18	M	Yes, five years prior—did a needling		L.P. Later 6/6 –		Cataract originally		
Lloyd	1928			Old penetrating				Hypermature cataract		
Cardell & Doyne	1929	47		? Intraocular For. Body	Yes					Breakdown of lens
Koby	1932			Old penetrating			—		Yes	
Hughes	1937						Raised		Yes	Degenerated vitreous
Knapp	1937	67	F			No L.P.	Raised	Hypermature cataract		
Danielson	1947	21	M	Penetrating		No L.P.	Normal	Cataract		Degenerated vitreous
Hubbersty & Gourlay	1953 1. 2. 3.	 77 75 83	 M M F			 L.P. L.P. ?	 Raised Raised Raised	 ? Hypermature cataract Cataract	 Yes Yes Yes	Degenerated lens cortex
Bonaccolto*	1954 1. 2.	 74 80	 F M	 ? No	 Yes	 L.P. L.P.	 Raised Low	 Mature cataract Mature cataract		 Degenerated vitreous Degenerated vitreous
Gruber†	1. 2. 3. 4.	26 75 71 53	M M F F	Old non penetrating No No No	Yes Yes	No L.P. L.P. L.P. No L.P.	Normal Raised Raised Raised	Hypermature cataract Mature cataract Hypermature cataract Hypermature cataract		
Total 21				8 ? in 2	4		Up in 9	15	6	

* Cases 1 and 2 reported in present paper.
† Cases 3, 4, 5, and 6 reported herein.

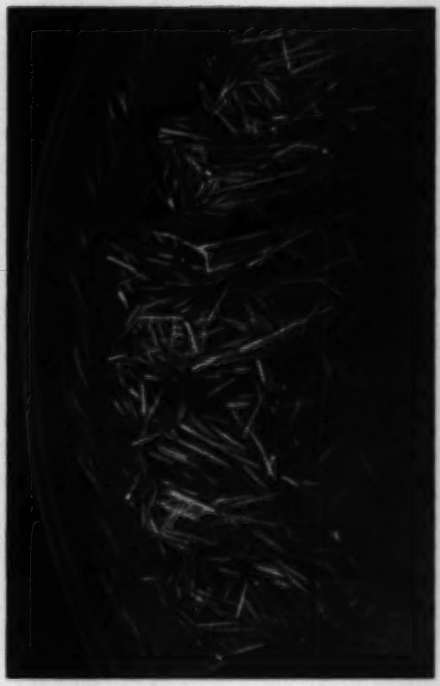


Fig. 9 (Gruber). Crystalline degeneration within the adult nucleus (Berliner[11]).

and crystals. Davson[16] in his book on the physiology of the eye states that in the normal lens the β and γ crystallines neutralize the α crystallines, and consequently lens rupture is not followed by an immune reaction. If this balance is upset, however, as when a cataract is present, the individual may become sensitized to the α crystalline.

The six cases I have described, together with most of the ones recorded in the literature, have all been associated with a mature or hypermature cataract. In those cases in which the cataract was removed, the fundi were essentially normal and there was no evidence of previous detachment or synchysis scintillans. This suggests that in the majority of cases the crystals originate from the lens. A cataract with crystals present in the anterior chamber suggests a rupture of the lens capsule and this should be looked for in every case. Examination of the aqueous may show cholesterol crystals derived from degenerate lens cortex. If glaucoma is present in such a case, one should not hesitate to perform a cataract extraction as a primary procedure.

Vitreous origin

Synchysis scintillans is a well-known condition in which glittering, golden, flat, angular particles lie in a fluid vitreous. It occurs in degenerative conditions of long standing, following trauma, hemorrhage, or inflammatory lesions. The particles settle at the bottom of the vitreous cavity when the eye is still, but move about in showerlike fashion when the eye is moved. They have been shown to consist of cholesterol crystals, which originate from a diseased retina or degeneration of the vitreous structure. It is not difficult to imagine from this description that what we are actually seeing when we look at the crystals is, in fact, a synchysis scintillans, which has somehow come forward into the anterior chamber.

Many of the cases reported had had a previous injury, which could well account for a diseased retina and fluid vitreous causing a synchysis scintillans. The crystals could come into the anterior chamber if the zonule of Zinn has degenerated, or if the lens has become dislocated.

The vitreous has no active metabolism of its own, so the changes which occur in it are determined by the adjacent structures which may saturate the vitreous with products of metabolism such as cholesterol.

Vitreous does not heal when it is cut or torn, and its framework becomes replaced by fluid.

The crystals are much better tolerated in the vitreous than they are in the anterior chamber, where they may easily set up an iridocyclitis or glaucoma. Figure 10 shows a picture of synchysis scintillans in an aphakic eye following a severe hemorrhage which occurred five days postoperatively.[17]

Fig. 10 (Gruber). Synchysis scintillans in the anterior chamber of an aphakic eye (Berliner[11]).

Fig. 11 (Gruber). Cholesterol slits in the subretinal fluid.

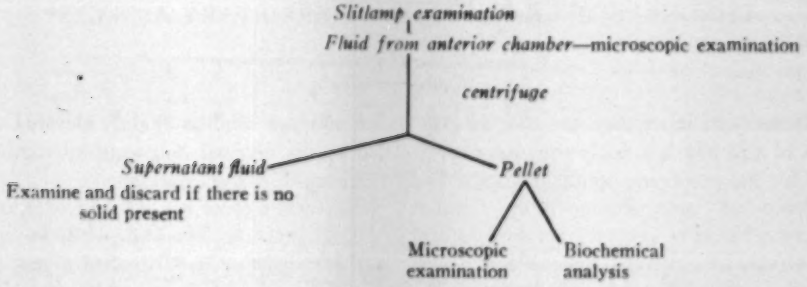
Subretinal fluid origin

Some ophthalmologists believe that the crystals always come from subretinal fluid, because they have only seen them in cases following a detachment of the retina. Certainly cholesterol slits are commonly seen in this position in sections of enucleated eyes which show a detached retina (fig. 11). This eye had had two previous operations for detachment of the retina. There was no light perception, the tension was soft, there were posterior synechias, and a dense mature cataract. The retina was completely detached and there was a large amount of heavily staining fluid in the vitreous cavity which contained some pigment cells, giant cells, and cholesterol slits. The subretinal fluid resembles fluid vitreous in constitution but has a higher albumen content. As the age of the detachment increases, the albumen content increases. Eventually the fluid becomes laden with cellular elements of disintegration, epithelial debris, and maybe crystals of cholesterol.

Unfortunately it was not possible to identify the nature of the crystals in any of the six cases that I have presented. In the three that came to surgery, some aqueous was removed for examination but none of the crystals seen with the slitlamp could be seen under the microscope. Other authors on this subject have omitted to explain how they actually identified the crystals as cholesterol, and one must assume that the reason for this is that there has been no true identification other than microscopic. It is not enough to make a smear of the aqueous on a slide and look for the crystals, as many times the portion examined would not contain any, as we have found. Even if crystals were seen microscopically, this would not be sufficient proof in itself that they were composed of cholesterol.

Having discussed this problem with a biochemist, it is my intention in future cases to submit the material to a more detailed analysis. This should only be performed by some one who has a knowledge of exactly what is required. The aqueous should not be sent

SCHEME OF EXAMINATION OF THE CRYSTALS



to the ordinary chemistry laboratory for examination, because the chances are that the analyst would not know what specific tests to perform. This is one time when the ophthalmologist and the biochemist should work together and have a definite preconceived plan, so that the material should not go to waste because of inadequate examination.

The first thing that has to be done is to see under the microscope the crystals that were seen under the slitlamp. Then the best way of identifying the material contained in the fluid removed from the anterior chamber is to centrifuge it, and then examine the pellet for crystals. If these are present, one must then determine the composition of these crystals by standard biochemical methods.[18]

SUMMARY

The literature on the subject of crystals in the anterior chamber is reviewed, and six cases showing this phenomenon are reported. The etiology of the crystals is discussed, and also their different sites of origin. Their true composition, however, has still to be settled. A scheme for examination of the crystals is outlined, in the hope that ophthalmologists will be persuaded to co-operate with the biochemist so that the true nature of the crystals may be determined.

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CHRONIC SIMPLE GLAUCOMA: HEREDITARY ASPECTS*

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Discovery of more than one case of glaucoma in a family is a fairly common experience for the practicing ophthalmologist. The incidence of such demonstrably familial glaucoma has been reported between 13 and 25 percent, as illustrated in Table 1. These statistics were obtained by careful investigation of the family history of routine glaucoma patients. Such figures may be interpreted to mean that the ophthalmologist can expect to find an additional case of glaucoma for every five known glaucoma patients simply by taking a family history.

Discussion of the pedigree shown in Figure 1 will illustrate the extent of information which may be uncovered by genetic investigation. The propositus, IV 13, at the age of 60 years, requested a routine eye examination. Personal acquaintance with the patient made it evident that her real reason for seeking examination was concern over the fact that her father had gone blind from "getting paint in one eye," an aunt had become blind "due to caring for a blind woman," and other members of the family were blind "perhaps because of indiscreet behavior."

CASE REPORT

IV 13 is a 63-year-old diabetic white woman. She has been followed for three years with the diagnosis of chronic simple glaucoma, well controlled by 0.75-percent Carcholin, three times daily, O.U. (pilocarpine allergy). Diagnosis was established by the water provocative test which reached a peak of 40 mm. Hg (Schiøtz), O.U. Although well controlled (15 to 25 mm. Hg Schiøtz) with medication, her tension was observed to rise to the low 30's O.U. when Carcholin was discontinued for three days last summer. Similar slightly elevated values led to the original diagnosis by routine tonometry. Fields are normal.

Refractive error is O.D., +1.37D. sph. ⌒ +1.0D. cyl. ax. 7°; O.S., +2.0D. sph. ⌒ +0.5D. cyl. ax. 5°. Corrected visual acuity is 20/15, O.U. The anterior chamber is somewhat shallow, however; the entire trabecular width is visible gonioscopically (while miotic). A prominent shelf of endothelial tissue is apparent on slitlamp examination, and probably accounts for a pearly gray haziness overlying Schwalbe's line and the trabecular area. Vogt's white limbal girdle is present nasally, O.U.

The discs are of normal color, with prominent physiologic depression and the lamina cribrosa in their upper temporal portion. Vessels disappear around the edge of this depression but are separated from the scleral edge by a good margin of normal disc tissue. Minimal widening of the arterial light reflex is present. No evidence of diabetic retinopathy exists.

It was possible to trace this pedigree of German descent back to 1797, with inclusion of 73 individuals. Very large fifth and sixth generations exist but they are not plotted

TABLE 1

REPORTED INCIDENCE OF HEREDITARY GLAUCOMA: DETERMINED BY MORE THAN ONE AFFECTED MEMBER OF FAMILY

Author	No. Patients	Percent
Biro[1]	125	13.0
Posner[2]	373	13.7
Probert[3]	571	17.8
Waardenburg[4]	142	24.7

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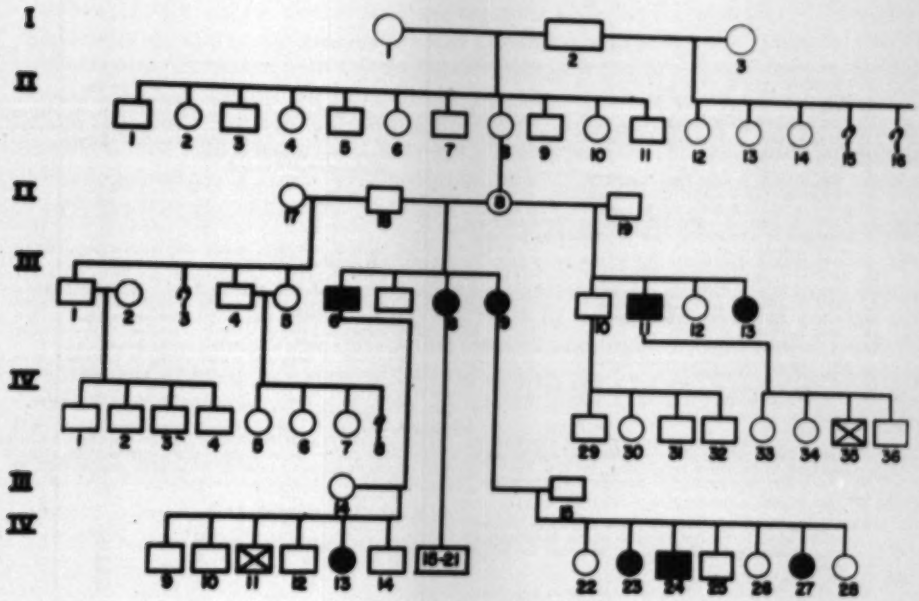

Fig. 1 (Havener). Glaucoma pedigree illustrates dominant inheritance.

since no members are old enough to exhibit any symptoms of glaucoma. It should be stated that there are no cases of hydrophthalmos or juvenile glaucoma in this family.

The untimely deaths of many of generation II (table 2) emphasize the advances made by modern preventive medicine and sanitation. Of 21 members of generations I and II, only five reached an age at which glaucoma could be exhibited (I 2, II 7, II 10, II 13, and II 19). Information as to the vision of these five individuals is sketchy, but it is quite certain that none was handicapped by complete blindness.

Nine members of generation III reached an age at which glaucoma could be manifested. Two of these entered the pedigree by marriage. Of the seven blood relatives living beyond the age of 60 years, five suffered blindness of gradual onset occurring between 60 and 80 years of age. The histories of these individuals are outlined in Table 2 (III 6, III 8, III 9, III 11, and III 13). As described, it is believed that in all five glaucoma was the primary cause of blindness.

The first eight members of generation IV are related through marriage, and are important primarily because they show absence of glaucoma in descendants of II 18 by his first wife. Four of these eight are old enough to manifest glaucoma if it were present. Deserving of comment are the chorioretinal atrophy, iris freckles, and cataractous tendencies in this family. The outstandingly poor social adjustment of IV 1, 2, 3, and 4 is remarkable. Six members of generation IV in blood descent were over the age of 60 years and available for examination (IV 11, 13, 23, 24, 25, and 27). Of these, three (IV 13, 23, and 24) were diagnosed as having glaucoma. IV 27, on pilocarpine therapy prescribed by another ophthalmologist, had a borderline normal water provocative test.

Discussion

This pedigree illustrates dominant inheritance of chronic simple glaucoma. Half the

TABLE 2

HISTORIES OF INDIVIDUALS SHOWN IN PEDIGREE (FIG. 1)

I. 1. CFKR, b. 1798, d. 1839, age 41 years.
2. JCR, b. 1797, d. 1882, age 85 years.
3. RHR, b. ?, d. 1880, age ?.

II. 1. CFR, b. 1822, d. 1822, age 4 months.
2. CMR, b. 1823, d. 1823, age 1 month.
3. JGR, b. 1824, d. ?, age ?.
4. MLRS, b. 1885, d. ?, age ?.
5. CFR, b. 1926, d. 1927, age 1 year.
6. CFRR, b. 1828, d. 1852, age 24 years.
7. KWR, b. 1829, d. 1913, age 84 years.
8. CWR, b. 1831, d. 1888, age 57 years. Considerable historical data available, none of which suggests any ocular disease.
9. GFR, b. 1833, d. ?, age ?.
10. RFR, b. 1835, d. 1905, age 70 years.
11. ACR, b. 1836, d. 1836, age 2 weeks.
12. MPR, b. 1842, d. 1897, age 55 years.
13. ECR, b. 1845, d. 1928, age 73 years.
14. JMR, b. 1849, d. ?, age ?.
15. and 16. Infants on whom further information is unavailable—presumably death occurred early.
17. First wife of JB, name ?.
18. JB, first husband of CWR, b. ?, d. 1864, age ?.
19. GM, second husband of CWR., b. 1838, d. 1920, age 82 years.

III. 1. JB II.
2. M ? B, genealogy never known to any members of family. Behavior by history suggestive of a depressive psychosis. Note fate of her children, IV. 1, 2, 3, 4.
3. Infant, died on transatlantic passage from Germany.
4. AS
5. EBS
6. WB, b. 1856, d. 1931, age 95 years. Gradually became totally blind during last 15 years of life. Both retinal hemorrhages and glaucoma are reported as being present.
7. AB, b. 1858, d. 1927, age 69 years.
8. ABP, b. 1860, living in Idaho. Reported to have been blind for many years, this being ascribed to glaucoma.
9. MEBM, b. 1864, d. 1948, age 84 years. Blind for 25 to 30 years, diagnosed by an older physician as glaucoma. (She, however, always felt it was due to her having cared for an aged blind woman during her younger life!).
10. CM, b. 1870, d. 1934, age 64 years.
11. LM, b. 1871. Personally examined. Totally blind, with semidilated and nonreactive pupils. Slightly shallow anterior chambers, O.U. Fairly dense cataract O.U. Black fundus reflex, O.D., (vitreous hemorrhage). Red reflex, O.S., with no details visible. Finger tension slightly elevated (tonometer tension impossible). Reported glaucomatous original etiology.
12. LM, b. 1873, d. 1892, age 18 years.
13. CMH, b. 1876. Personally examined. O.S. has been enucleated for absolute glaucoma, O.D. on pilocarpine with T.T. 18. Marked glaucomatous optic atrophy. Vision hand movements and limited to a 10° central area. Also has circinate macular retinopathy and early nuclear and cortical catract.
14. MBB, b. 1862, d. 1949, age 87. Her parents and 3 siblings had no ocular complaints. Her mother lived to age of 93 years, and 2 siblings were 80 and 86 years.
15. JHM, b. 1860. Living, without ocular complaints or history of familial eye difficulty.

IV. 1. HB, drug addict and vagrant.
2. AB, Suicide when young.
3. JB, III, alcoholic.
4. BB, committed to insane asylum.
5. BS, b. 1879. Personally examined. W.C. O.D. 20/50, O.S. counts fingers. Deep anterior chambers. Many iris freckles. Circumpapillary chorioretinal atrophy. No glaucomatous cupping. Nuclear catract O.U. (Mother had cataracts.) Tonometer tension 20 O.U.
6. ESS, b. 1884. Personally examined. W.C. 20/30 O.U. Deep anterior chamber. Scattered iris freckles. Normal discs with circumpapillary chorioretinal atrophy. Rather marked focal nutritional atrophy in inferior periphery. Tonometer tension 20 O.U.
7. ISA, b. 1889. Personally examined. W.C. 20/25, O.U. Deep anterior chamber. Iris freckles. Disc normal. Tonometer tension 18 O.U.
8. Died in infancy.
9. WHB II., b. 1882, inaccessible for examination.
10. CGB, b 1883, inaccessible for examination.
11. WAB, b. 1885. Personally examined. W.C. 20/20 O.U. Very shallow anterior chambers. Definite suggestion of cupping of discs O.U., with unusually prominent lamina cribrosa. No glaucomatous field changes. Tonometer tension 25, O.U.
Water provocative test

	O.D.	O.S.
Initial	20	20
15′	28	28
30′	25	25

12. ELB, b. 1890. Has shallow anterior chambers. Further examination refused.
13. LBH, b. 1892. Personally examined. W.C. 20/15 O.U. Controlled well Carbachol for 3 years (pilocarpine allergy). Very shallow anterior chambers, normal discs. Postendothelial tissue in chamber angles. Field normal. Tensions to 40 on water provocative test 3 years ago.
14. RFB, b. 1896. Inaccessible to examination.
15. 15–21—6 boys and 1 girl, living in western U.S.A., inaccessible to examination, no knowledge of visual status.
22. AEM, b. 1887, d. 1897, age 10 years. Death due to diphtheria.
23. LEMR, b. 1888. Personally examined. W.C. O.D. 20/30, O.S. 20/25. Shallow anterior chambers. Drusen inferiorly. Questionable early cupping, O.S. Visual fields normal 2/1000 W. Tonometer tension O.D. 30, O.S. 35. On pilocarpine 4 years from another ophthalmologist.
Water provocative test:

	O.D.	O.S.
Initial	23	25
15′	27	30
25′	30	34
40′	30	32

24. WGM, b. 1889. Personally examined. W.C. O.D. 20/30, O.S. 20/40. Visual loss began insidiously 3 years ago. Poorly controlled with pilocarpine and D.F.P. and surgery recommended by another ophthalmologist. Shallow anterior chambers. O.D. miosis conceals fundus. O.S. marked glaucomatous optic atrophy with cupping. Large inferior Bjerrum O.D.; loss of most of temporal field O.S.
25. CLM, b. 1890. Examined by another ophthalmologist and reported not diagnosed as glaucoma.
26. EEM, b. 1892, d. 1922, age 30.
27. LIMR, b. 1894. Personally examined. W.C. O.D. 20/20, O.S. 20/30. Pilocarpine Rx, for over 10 years by another ophthalmologist. Somewhat shallow anterior chambers. Discs normal. Two paracentral scotomata O.S. from old chorioretinitis. No glaucomatous field changes. Tonometer tension 25 O.U.

	O.D.	O.S.
Initial	25	22
15′	30	30
25′	28	28
40′	28	28

28. CHMF, b. 1900. Personally examined. W.C. 20/20 O.U. Anterior chambers normal depth. Many drusen of peripheral retina. Gliosis overlying discs. Tonometer tension O.D. 27, O.S. 24.
29. RWM, died in infancy.
30. MAMW, b. 1900. Personally examined. O.U. 20/20, 20/20, TT 18 O.U. Anterior chambers of normal depth. Discs normal.
31. HGM, b. 1900.
32. CRM, b. 1904.
33. EKM, b. 1896. Personally examined. W.C. 20/20 O.U. Early cortical catract inferior nasal quadrant O.U. Deep anterior chamber and normal discs. Tonometer tension 24 O.U.
34. MMM, b. 1900. Personally examined. W.C. 20/20 O.U. Anterior chambers and discs normal. Few small axial opacities of posterior lens. Tonometer tension 02, O.U.
35. ELM, b. 1909. Personally examined. W.C. 20/30, O.U. Very slightly shallow anterior chambers. Discs normal. Tonometer tension 28, O.U. (squeesing?). Recheck in A.M. 24 O.U.
36. MCM, b. 1914. Inaccessible for examination.

children of II 8, by two husbands, became blind from glaucoma. In turn, almost half the offspring of these affected individuals have to date manifested early glaucoma. Since II 8 died at the age of 57 years, she did not herself manifest glaucoma, although her affected offspring from two marriages clearly implicate her as transmitting the disease.

This pedigree illustrates the difficulties attendant upon obtaining information on a disease manifested only in later life: (1) Many die before manifesting the disease; (2) the family history becomes very sketchy beyond one generation in the grave; (3) younger generations are not yet old enough to exhibit the disease.

I am in complete agreement with such authors as Posner and Probert (Refs. 2 and 3, Table 1) who point out that the predominance of "juvenile" glaucoma in the reported pedigrees of hereditary glaucoma results from selection of unusual cases for publication.

SUMMARY

1. A pedigree illustrating dominant inheritance of chronic simple glaucoma is presented.

2. In 13 to 25 percent of cases of glaucoma, careful investigation has shown other members of the family to be glaucomatous.

3. It is recommended that patients with glaucoma should be advised of its hereditary nature. In this way their affected relatives may receive the benefits of earlier diagnosis and therapy.

The Ohio State University (10).

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OPTICAL PRINCIPLES OF LOUPE MAGNIFICATION

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Interest in telescopic and so-called microscopic lenses for the partially sighted has lately increased considerably. Little, however, has been heard about another type of visual aid, the magnifying loupe. Like the microscopic lens, the magnifying loupe serves for the improvement of near vision. It is invariably less expensive and in some cases just as effective.

In order to put magnifying loupes to best use, their optics must be understood; it is the purpose of this paper to explain the optical principles of loupe magnification in an elementary manner. Details of clinical application will be treated in a subsequent paper. For the simplification of both the diagrams and the formulas it will be assumed that the magnifying loupe is infinitely thin and that the eye has a simple nodal point. It also will be taken for granted that the eye has no refractive error and that, within reasonable limits, it can accommodate for any desired distance.

By common understanding, the magnifying loupe is a convex lens of moderate dioptric power, held at some distance from the eye. This distance usually is greater than the distance of conventional spectacles, but not greater than about arm's length. Viewed through it are rather small objects which are held within the focal length of the loupe. This latter limitation is essential. If an object is outside the first focus of a convex lens, but not further from the lens than twice its focal length, the optical image will be magnified. This image however will be real and therefore inverted. The image obtained through loupe magnification is not to become inverted; it must be virtual. Optically speaking, the eye looks at this erect virtual image which is

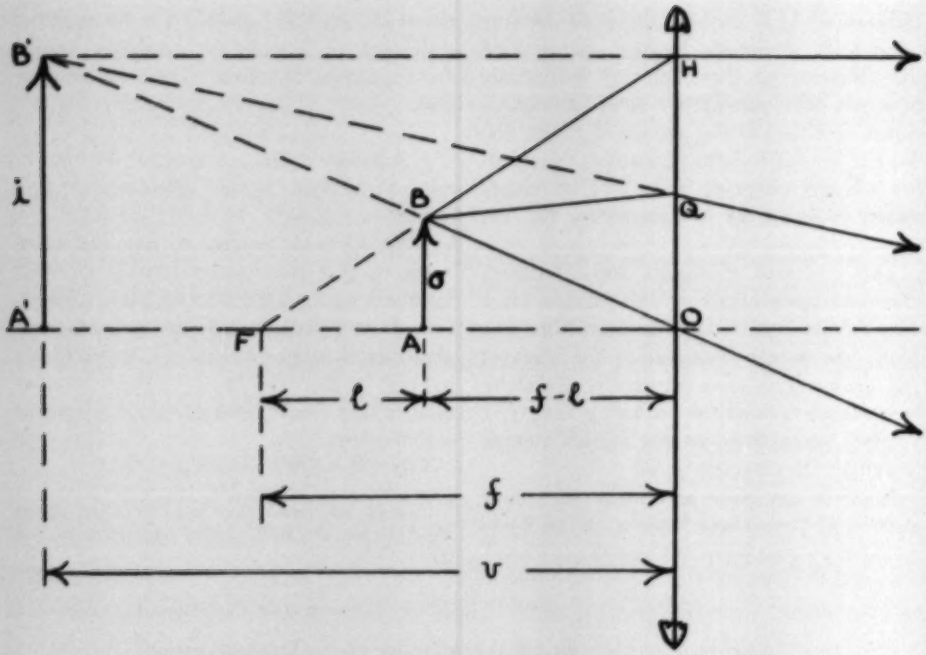

Fig. 1 (Linksz). Diagram to show relationships between an object and its virtual image produced by a convex lens.

the effective object as far as the eye is concerned. The size of this effective object, or ocular object, and its distance from the eye determine the size of the retinal image and the effective retinal magnification.

The relationships between an object and its virtual image produced by a convex lens are easily established with the help of the diagram given in Figure 1. In this figure, AB represents an object o, and $A'B'$ the image i; F is the first principal focus and O the optical center of a (infinitely thin) convex lens. The focal distance FO of the lens will be called f; the distance FA of the object from the focus will be called l. The letter v will stand for the distance $A'O$ of the image from the lens. The distance AO of the object from the lens equals $(f-l)$. The size and position of the image are found by using the rays $(F)BH$ and BO in the well known manner. (The first of these rays, while actually issuing from B, behaves as if coming from the direction of F. Therefore, hitting the lens at H, it leaves the lens parallel to the principal axis. The second ray passes through O; it thus remains undeflected. The backward prolongations of these rays meet at B'; thus B' is the virtual image of B and the position and length of the line $A'B'$ gives both the position and the size of the virtual image which eventually is to become the object for the eye. This is not yet shown in the diagram.) The just given points and their connections outline several pairs of similar triangles, like FAB and FOH or OAB and $OA'B'$, and since some of these linear values are given, others can be calculated by well known rules which govern similar triangles. The linear values $A'B'$ and OH are obviously equal; i can therefore be substituted for OH and, from

the first pair of similar triangles it can be determined that

$$\frac{i}{o}=\frac{f}{l} \tag{1}$$

or

$$i=\frac{of}{l}. \tag{1a}$$

In the latter equation, all three values of the right side are known and i can be calculated. Equation (1) is, by the way, the well known Newtonian magnification formula which expresses the size relations between image and object ($i:o$) in terms of two other given linear values, f and l.

The second pair of similar triangles presents another expression for this relationship, viz.

$$\frac{i}{o}=\frac{v}{f-l} \tag{2}$$

and since the left sides in equations (1) and (2) are equal it is obvious that

$$\frac{f}{l}=\frac{v}{f-l}.$$

Thus, in the case of the virtual image produced by a convex lens, it can be stated that

$$v=\frac{f(f-l)}{l}=\frac{f^2-fl}{l}. \tag{3}$$

Since the essential condition which makes convex lenses act as loupes is the presence of the object inside the principal focus, l can vary only between 0 and f. In the first extreme case, both i and v become infinite; in the second extreme case, i becomes equal to o and v becomes zero which means that image and object coincide and that there will be no magnification. At any in-between value, i is always larger than o and v is larger than $(f-l)$; thus, for all practical purposes, the virtual image (which is the object of vision in loupe magnification) is always larger than the actual object and farther from the lens than the latter.

The equations so far quoted are valid for convex lenses and virtual images formed by them in general. Only by its being at a reasonable distance from an eye and in connection with the optical system of this eye, does a convex lens become a loupe and influence the size of the retinal image. It was stated earlier that, in order to simplify matters, it will be assumed that the eye has but one nodal point and that it is able to accommodate for any desirable distance. Moreover, it will be assumed that accommodation does not measurably change the position of the ocular nodal point in relation to the retina.

Figure 2 shows an object AB, or o, at the distance u from the nodal point N of an eye. In order to receive a sharp retinal image, this eye, assumed to be emmetropic, need accommodate $1/u$ diopters.* The angular size α of the retinal image is characterized by the relationship of the two just given linear values:

$$\tan\alpha=\frac{o}{u}. \tag{4}$$

Obviously, the larger the distance u, the smaller is the retinal image of any object o. It is the increase of the angular value α of this retinal image with which loupe magnification is concerned.

Figure 3 shows a convex lens interposed between the object and the eye. To make it serve as a loupe, the distance of the object from the lens must be smaller than f. The distance u of the object from the eye is now a composite of two values, namely the sum of the distance between loupe and eye, z, and of the distance $(f-l)$ between object and loupe. Now, the interposition of a loupe between eye and object throws the virtual image of the latter as far as

$$v=\frac{f(f-l)}{l} \tag{3}$$

* u being expressed in meters.

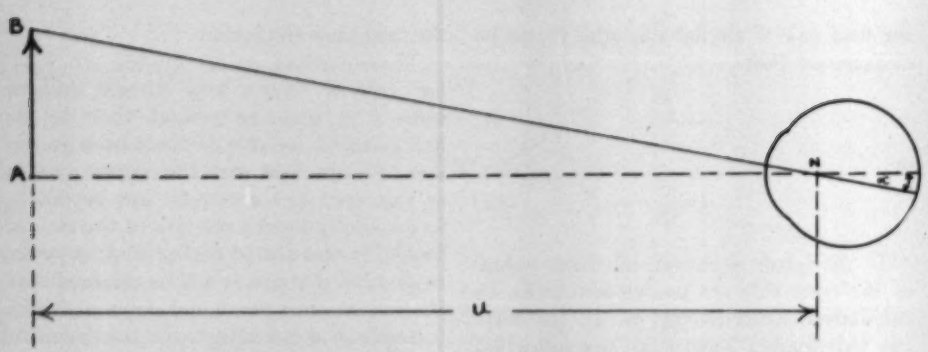

Fig. 2 (Linksz). Shows object AB, distance u from nodal point N of an eye, and angle α.

from the lens. Thus, the distance of the virtual image from the eye becomes

$$y = \frac{f(f-l)}{l} + z. \qquad (5)$$

To see this virtual image, which is the object of vision, the eye need accommodate $1/y$ diopters.* Since y is, by the nature of things, always larger than u, less accommodation is needed when viewing objects through a loupe—an advantage many an early presbyope makes use of, even if he is otherwise not in need of magnification. The size of this virtual image has been found to be

$$i = \frac{of}{l} \qquad (1a)$$

a value which, obviously, represents the

* y being again expressed in meters.

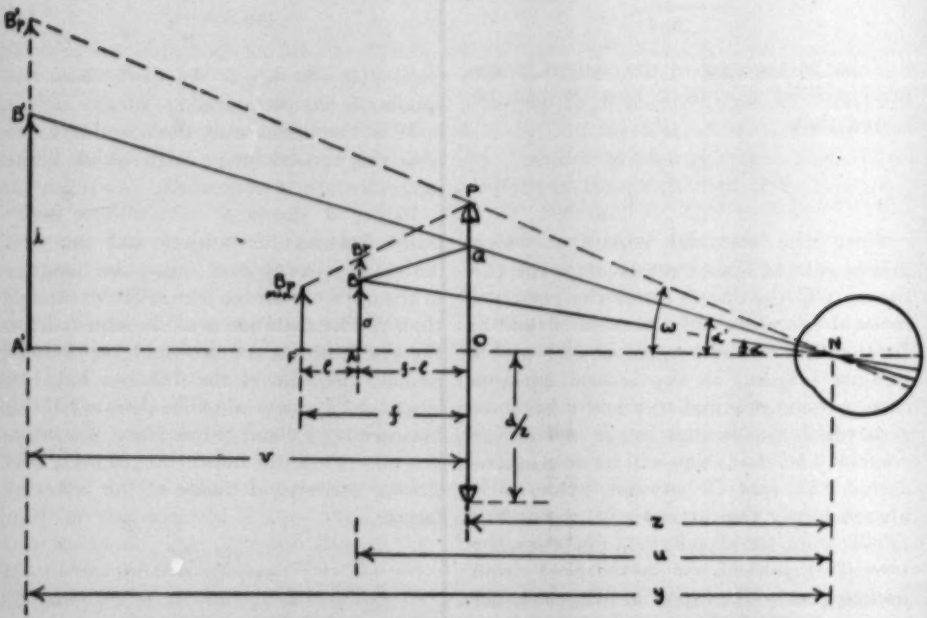

Fig. 3 (Linksz). Shows a convex lens interposed between the object and the eye.

size of the ocular object. The size of the retinal image of the object seen through the loupe can be characterized by a tangential relationship similar to equation (4), namely

$$\tan \alpha' = \frac{i}{y} = \frac{\frac{of}{l}}{\frac{f^2 - fl + zl}{l}} = \frac{of}{f^2 - fl + zl}. \quad (6)$$

While this is an easy equation to solve, it is in many cases more advantageous to substitute the rather incidental value z by a term containing u, the distance of the actual object from the ocular nodal point. Thus

$$\begin{aligned} y &= v - (f - l) + u \\ &= \frac{f^2 - fl}{l} - f + l + u \\ &= \frac{f^2 - 2fl + l^2 + ul}{l} = \frac{(f-l)^2 + ul}{l} \end{aligned} \quad (5a)$$

and

$$\tan \alpha' = \frac{\frac{of}{l}}{\frac{(f-l)^2 + ul}{l}} = \frac{of}{(f-l)^2 + ul}. \quad (6a)$$

Since the angular values encountered in clinical optics usually are small and only limited accuracy is necessary, the tangents found in equations (4) and (6a) can just as well represent the actual angles. The magnification of the retinal image by a loupe is therefore

$$\begin{aligned} m &= \frac{\tan \alpha'}{\tan \alpha} = \frac{\alpha'}{\alpha} = \frac{\frac{of}{(f-l)^2 + ul}}{\frac{o}{u}} \\ &= \frac{uf}{(f-l)^2 + ul}. \end{aligned} \quad (7)$$

Assuming now that, in a given case, the actual distance u between eye and object is always kept constant, the question arises: What happens if a loupe of some (obviously constant) focal distance f is brought closer to the eye or to the object; in other words, if the distance l is varied? According to the definition of a loupe, l can, in the case of a loupe, only vary between zero and f and as usually in optics one will gain valuable information by analyzing these extreme values. To make l approach f, the loupe has to be brought very close to the object. Setting $l = f$, equation (7) reads

$$\frac{\alpha'}{\alpha} = m_{\min} = \frac{uf}{uf} = 1. \quad (7a)$$

Thus, a loupe has no (or little) magnifying effect if it is brought too close to the object, whatever its power may be. The size of the retinal image depends in this case entirely on the actual distance u of the object from the eye (it becomes smaller as u increases).

Much more remarkable is the result arrived at by setting l = zero, the case in which the loupe is held almost as far from the object as the loupe's focal length. Though both i and v tend to become infinitely large, no unlimited degree of magnification can be achieved by bringing the loupe too far forward—not even any desired amount. Setting l = zero, equation (7) changes to

$$\frac{\alpha'_{\max}}{\alpha} = m_{\max} = \frac{uf}{f^2} = \frac{u}{f} \quad (7b)$$

the maximum value of m for any given distance u.

The existence of such a maximum should be understandable. The virtual image soon gets too far from the eye for its actual enlargement to be of any further advantage for vision. With any given u and f, magnification soon reaches optimal values and thus there will be nothing gained by bringing the loupe any closer.

One example will suffice to demonstrate this: Holding the object at, for

example, 18 cm. from the eye and a +12.5D. loupe 6 cm. in front of it, magnification of the retinal image is ×2. Magnification increases to ×2.15 when the loupe is held 7 cm. from the object and maximum possible magnification—holding the loupe nearly 8 cm. from the object—is ×2.25. The main difference lies not so much in the magnification as in the amounts of accommodation necessary to receive a sharp retinal image. The nearer one brings the loupe, the less one need accommodate.*

Studying equation (7b), some more about magnification by loupe will be learned. It is obvious that for any given object distance u, optimum magnification increases with diminishing f; thus, stronger loupes give more magnification and they can be held farther from the eye than weaker loupes, while u remains constant. This is of great psychologic importance. The elderly partially sighted patient is most unhappy about the short range, rigidly to be enforced, whenever he tries to use a microscopic lens. He can achieve less magnification with a loupe, but at a much more comfortable range. And he can actually hold a stronger loupe (one offering greater magnification) further than a weaker one, while maintaining the same distance u. (The disadvantages of too much magnification, the distortions caused by strong lenses, the retardation of reading speed by undue increase of letter size, the limitations of the field, are not to be considered in the present paper.) It would be wrong, however, to conclude from the presence of u in the numerator of equation (7b) that there are unlimited possibilities in loupe magnification by increasing the distance u between object and eye. Substituting o/u for α† into equation (7b), the following important result is arrived at:

$$\frac{\alpha'_{max}}{\frac{o}{u}} = m_{max} = \frac{u}{f}$$

$$\therefore \quad \alpha'_{max} = \frac{o}{f}. \qquad (8)$$

This equation, at first sight, appears strange. According to it, the size of a retinal image would be independent of object distance (u does not figure in the equation) while, at the same time, it is clear from equation (7b) that magnification (even maximum magnification) of the retinal image increases with u. Still, the equation is correct and the maximum actual size α'_{max} of the retinal image of some given object o, seen through a loupe of $1/f$ diopters power, is in fact independent of the distance between object and eye; it is only the magnification that changes and so does, of course, the original size α of the retinal image seen without the interference of a loupe. The value α decreases with increasing u, while m increases; and since the increase of m with increasing u just makes up for the decrease of α with increasing u, the size of the magnified retinal image α'_{max} is in the final analysis independent of u. It is constant for any given o and f. If the loupe is held as far (or almost as far) from the object as its focal length and if the object and the loupe are *moved together* toward the eye or away from it, the size of the retinal image is unchanged.

This fact, while theoretically interesting, is of definite importance besides. According to the formula, α'_{max} remains unchanged whatever the value of u. It should thus be possible to read print smaller than Jaeger 1 as well with the help of a loupe from across the street as it is from arm's length. This is true, at least in principle. In actuality, such matters are limited—as much by the inaccuracies of elementary optical formulas which are

* A presbyope will hold the loupe as far from the object as possible (nearly 8 cm. in the given example) since in this case i is infinitely far and no accommodation or reading lens is needed.

† Cf. equation (4).

only approximations, as by the decrease, with the square of distance, of the light energy which emanates from any object. Besides, the diameter of the loupe itself acts as limiting factor of useful magnification, as a kind of stop or entrance pupil. As z increases, the angular size of this entrance pupil, as measured from the observer's eye, becomes smaller and smaller.

The size of the largest object which is entirely visible through a loupe varies, first of all, with its diameter d and, other things kept unchanged, varies inversely with the distance z of the loupe from the eye. The diameter d and the distance z determine quasi a cone of lines of direction with its base at the loupe, its apex at N, and an apical angle of 2ω. Vision through a loupe is limited to the lines of direction which make up this cone. The dotted lines added to the diagram of the loupe (Fig. 3) should clarify this. Line PN represents the direction of the most peripheral ray which, modified in direction by the loupe at P, still reaches the retina (assuming that the pupil of the eye is point-sized and in the plane of N). This ray, while actually coming from an object point B_p in the object plane, appears to come from B'_p in the image plane, along the backward prolongation of ray PN. Thus, AB_p is the maximum length of an object, o_{max}, fully visible at a given u value; $A'B'_p$ is the corresponding maximum image, i_{max}. The angle ω subtended by the common principal axis of the combined system, loupe and eye, and the ray $(B'_p)PN$ equals one half of the total angle of the entrance pupil and B_p is the most peripheral point seen through the loupe in the indicated setting.

However, d and z determine the cone of lines of direction only; they are not the only limiting factors to the field seen through a loupe. Even if they, and with them ω, are kept constant, and even if one certain loupe of the power $1/f$ is considered, more of a line of letters is visible through the loupe if l increases, and less if it decreases. The broken line from $B_{p_{min}}$ to P in Figure 3 indicates the possible loci of B_p and the possible lengths of the line AB_p with the changes of l, if d, z, and f are given and constant. If l approaches f, in other words, if a line of letters is brought very close to the loupe, m approaches 1* and AB_p approaches a maximum, OP. Thus, the greatest length of a line of letters seen through a loupe cannot exceed the diameter d of the loupe. If, on the other hand, l approaches zero, in other words, if a line of letters is brought close to the focal plane of the loupe, them m becomes maximum,† but the length AB_p of one half of the longest visible part of a line of letters approaches a minimum value and it becomes equal to the distance $FB_{p_{min}}$ if l became zero.

The actual values of the variable distance AB_p are found by the following consideration:

It is obvious from Figure 3 that

$$\frac{\frac{1}{2}d}{z} = \frac{i_{max}}{y} = \tan\omega$$

for any given value of y. Substituting $o_{max}f/l$ for i_{max}‡ and $f^2-fl+zl/l$ for y,§ one gets

$$\frac{\frac{1}{2}d}{z} = \frac{\frac{o_{max}f}{l}}{\frac{f^2-fl+2l}{l}} = \frac{o_{max}f}{f^2-fl+2l} \qquad (9)$$

and

$$AB_p = o_{max} = \frac{1}{2}\cdot\frac{d(f^2-fl+2l)}{zf} \qquad (10)$$

The distance $2o_{max} = 2AB_p$, or the maximum length of a line of letters seen through a loupe can thus be calculated for any loupe of known power $1/f$ and diameter d, for any distance z between loupe and eye

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* Cf. equation (7a).
† Cf. equation (7b).
‡ Cf. equation (1a).
§ Cf. equation (5).

and for any distance $(f-l)$ between print and loupe. Keeping all other values constant but the last, the length of $2AB_p$ must vary with l. It is, as mentioned, a maximum and equal to d when the print is brought close to the loupe, and a minimum when the print is brought into (or close to) the focal plane of the loupe (the condition in which α' becomes constant). Equation (9) changes in this case to

$$\frac{\frac{1}{2}d}{z}=\frac{o_{max}f}{f^2}=\frac{o_{max}}{f}. \qquad (9a)$$

To indicate the fact that $o_{max}=AB_p$ varies with varying l (cf. fig. 3), its greatest value OP will be called $o_{max\,(max)}$; its smallest value $FB_{p.\,min}$ is designated as $o_{max(min)}$.

Assuming then that the diameter d and the distance z of different loupes from the eye are kept constant and the print always held in their respective focal planes, it is obvious from equation (9a) that $2o_{max\,(min)}$, the maximum length of a line of letters visible through these different loupes, depends entirely on f becoming shorter as loupes get stronger.

The actual length of these lines for loupes of any power $1/f$ is derived by writing the equation in the form

$$o_{max(min)}=FB_{p.min}=\frac{\frac{1}{2}df}{z}=f\tan\omega$$

or

$$2o_{max(min)}=\frac{df}{z}=2f\tan\omega \qquad (10)$$

Obviously, whenever a line of letters is held in the focal plane of a given loupe (d and f are constant) for maximum retinal image magnification (α' = maximum), then the visible length of this line depends entirely on z, the distance of loupe (and letters) from the eye. It increases with diminishing z. Not magnification, but field is gained by holding loupe and letters as close to the eye as possible.

A few numerical examples will illustrate this point.

Assuming as an example that the length of a line of letters is 8 cm. and that the focal length of the loupe which is being used is also 8 cm., tan α'_{max} (the tangent of the largest possible retinal image of *one half* of the line) is $o/f=4/8=1/2$* and the angular size of the retinal image of the *total* line is about 53 degrees. This value will always remain constant. The retinal image of the total line seen through the loupe will always cover the same number of retinal elements. If now the radius of the loupe (half of its diameter) is 5 cm. and the loupe is held 10 cm. from the eye (the print is to be held another 8 cm. further than the loupe), the entrance pupil formed by the loupe at the observer's eye has the same angular value and the whole line is visible through the loupe. However, if one holds the loupe at 20 cm. from the eye (the print is again held 8 cm. farther than the loupe), then the tangent of one half of the entrance pupil becomes $5/20=1/4$ and the angular value of the entrance pupil about 28 degrees. Obviously, only about one half of the line of 8 cm. length will be seen through the loupe at one time. (The loupe would have to have a diameter of 20 cm. for a whole line of 8 cm. length to be visible through it at this distance.)

This entrance pupil becomes increasingly smaller if z is increased. Holding the loupe at the distance of 2.00 m. (the print must again be another 8 cm. farther), the tangent of one half of the entrance pupil becomes $5/200=1/40$ and the useful magnified retinal image will have an extension of less than three degrees. Hardly a longer word of newspaper print will be seen at a time and besides, by moving the head, the print will soon be lost altogether.

In spite of all these obvious limitations, the present author has often demonstrated to his audience that even smallest lettering on a stamp or on the face of a watch can

* Cf. equation (8).

very well be read across the room, even through a weak loupe, especially in bright daylight illumination.*

As far as practical application goes, the principle made evident by equation (8) is responsible for the great versatility of loupes as visual aids. Given some (small) object o and a loupe of the power $1/f$, visual performance is largely independent of object distance if the object is in, or near, the first focus of the loupe. An ophthalmic surgeon, a philatelist, a botanist, will vary his distance from the object he handles according to the most advantageous distance of this handling without losing any effective magnification and since i is always infinitely far, independently of presbyopia, if present. As mentioned earlier, stronger loupes can be held farther from the eye for any given constant value of u. It now turns out that u can be any distance. That both of these circumstances are welcome to the partially sighted is obvious. All he has to do is make sure that object and loupe be at constant distance from each other and that this distance be nearly that of the focal distance of the loupe. There are many commercially available devices to keep a loupe a certain distance from a printed page. The distance, of course, has to be well chosen and rigidly kept.

All this freedom of setting oneself at a desirable distance from the printed page is lost whenever a presbyope uses a loupe and his reading correction at the same time (or whenever a myope with no correction uses a loupe). In this case, y is limited. A person wearing, for example, a +4.0D. reading addition sees (at least theoretically) only such objects sharply which are 25 cm. from his lens. In order to see a magnified object sharply through a loupe, the distance y of the virtual image i must be 25 cm. from his reading lens.

* It should be possible to put this principle to some limited practical use, for example, by making house numbers or names over entrance doors better visible, or in some eye-catching advertising displays.

Equation (5a) has shown that

$$y=\frac{(f-l)^2+ul}{l}=\frac{f^2-2fl+l^2+ul}{l}$$

$$=\frac{f^2}{l}-2f+l+u.$$

From this it follows that

$$u=y+2f-\frac{f^2}{l}-l. \qquad (11)$$

Obviously, if a certain loupe is used (f is constant) and if there is no choice in the value of y because of a reading addition (or uncorrected myopia), u will vary with l. In other words, the distance between eye and object will have to be changed if the distance $(f-l)$ between object and loupe is varied.

A few numerical examples will clarify this. It will be assumed again that $f=8$ cm. and that $y=25$ cm. and is unchangeable. If the loupe is held 2 cm. from the object ($l=6$ cm.), u must be $24\frac{1}{3}$ cm. Thus, object and virtual image will almost coincide (the latter will only be $\frac{2}{3}$ cm. farther) and there will hardly be any useful magnification. If the loupe is kept 6 cm. from the object ($l=2$ cm.), u will become 7 cm. and the loupe will have to be held 1 cm. in front of the presbyopic reading addition. Magnification will again not be very effective. From equation (7) it is found that in this case

$$m=\frac{7\times 8}{(8-2)^2+7\times 2}=\frac{56}{50}=1.12.$$

Still, even if m is not very great, the loupe will not be without value. A loupe of $f=8$ cm. permits the presbyope wearing a +4.0D. reading addition to bring objects as close to his eye as 7 cm., a distance for which he would otherwise need a rather strong microscopic lens. Since 7 cm. is about one fifth of the standard reading distance of 14 inches (about 35 cm.), the approach in itself will magnify the retinal image by ×5.0. The additional,

though small, magnifying effect increases this to ×5.6. A person with not more than 14/70 (20/100 equivalent) near vision should be able to read the 14/14 print by such arrangement—not a minor achievement with such inexpensive means.

A case of especial interest is the one in which the object is held halfway between a loupe and its principal focus. In this case, $l = (f - l) = f/2$ and it follows from equation (3) that $v = f$. Thus, whenever an object is held halfway between a loupe and its principal focus, the virtual image is in the principal focal plane. Moreover, it follows from equation (1a) that $i = 2o$, whatever the power of the loupe.

These circumstances are of great interest in practical work. Whenever a presbyope has his reading distance fixed by a reading addition, he can be assured of ×2.0 magnification by *any* loupe, holding the loupe in such a manner that its principal focus coincides with the reading distance. At the same time, he is to hold the object halfway between this distance and the loupe. In the present example where f is assumed to be 8 cm. and y is 25 cm., it will be necessary to hold the object 21 cm. from the reading lens and the loupe another 4 cm. closer. Such arrangement is ideal for patients with not too great loss of vision. If a person has sufficient visual acuity (around 20/80) to read a magazine at 25 cm. with a +4.0D. reading addition, he will have ample sight to read a newspaper, or look up a telephone number, with any weak loupe, in case loupe and reading matter are placed into the positions just indicated. (For a +12.5D. loupe, these positions will be 17 and 21 cm. in front of the eyeglasses, respectively; for a +10.0D. loupe, 14 and 20 cm., and so forth.) As a matter of fact, even persons with less vision often prefer this arrangement to the microscopic lens; a patient with 20/160 visual acuity will be able to read a magazine with it.

Summary and Conclusions

Starting from the well known Newtonian formula for the relation between o (the size of the object) and i (the size of the virtual image), a system of equations is developed by which all magnitudes pertinent to loupe magnification can easily be ascertained. Such values are v (the distance of the image from the loupe), y (the distance of the image from the eye), α' (the angular size of the retinal image of an object as seen through a loupe), and m (the effective magnification of this retinal image).

It is shown that, while m changes with the distance of the eye from the loupe, α' (the size of the magnified retinal image) is largely independent of this distance once loupe and object are moved together. This explains why loupes can be used at any convenient distance, also by presbyopes who have no reading correction.

It is shown furthermore how the wearing of a presbyopic reading addition affects the usefulness of a loupe.

Finally, a simple formula is developed by which ×2 magnification can be achieved and a convenient reading distance retained when using a loupe of any power.

6 East 76th Street (*21*).

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AN EXPERIMENTAL CLINICAL EVALUATION OF DORSACAINE HYDROCHLORIDE* (BENOXINATE NOVESINE†)

Report on the instillation of a 0.4-percent solution

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I. Introduction

Since the discovery of the medical usefulness of cocaine by Koller in 1884, chemists and pharmacologists of many countries have been inspired to create new and better substances for surface anesthesia. The configuration of the molecules has been arbitrarily changed to improve their properties and diminish the remaining disadvantages. One drug has been quickly substituted for another until in 1931, among numerous synthetics, the use of tetracaine (pantocain, pontocaine) became prevalent. In the offices and clinics of the entire modern ophthalmologic world it now seems to be the most widely used surface anesthetic. However, just as procaine is gradually being replaced by the longer acting xylocaine (Sweden), so the efforts to supplant pontocaine seem to be gaining ground.

Since there are numerous available anesthetics which fulfill the essential requirements, such as not influencing tension, the reaction of the pupil, and accommodation, and possessing low toxicity, the subjective factor, that is, the comfort of the patient, becomes decisive. Pontocaine (I. G. Farben, 1931) won out against benzocaine (1890), holocaine (1896), alypin (1912), phenacaine (1915), butyn (1919, allocaine (1919), tutocaine (1922), metycaine (1927), nupercaine (1929), larocaine (1930), and many others chiefly because it was less irritating. On the other hand, Herman, Moses, and Friedenwald[1] have demonstrated that pontocaine in one-percent solution does decrease the consumption of oxygen by the cornea and inhibits to 88 percent of dehydrases. That pontocaine also causes a temporary superficial punctate keratitis in nearly every case has been pointed out by Swan.[2]

The purpose of this investigation is to evaluate experimentally the clinical usefulness of dorsacaine, a new compound developed in Switzerland, as compared with that of pontocaine. The various factors determining the efficacy of surface anesthetics will be examined in the order of their importance.

II. Subjective reactions due to surface anesthetics

The subjective reactions following the instillation of dorsacaine and pontocaine were compared.

Experiment

The series included 408 unselected patients from the regular glaucoma and emergency clinics of the New York Eye and Ear Infirmary. These clinics are consulted by men and women of all ages afflicted with every type of glaucoma, some of short and others of long duration. Each patient received one drop of dorsacaine (0.4 percent) in the right eye and as a control a single drop of pontocaine (0.5 percent) in the left eye. The drops were always placed in the lower fornix and the eyes were closed afterward. The question asked was "Which drop burns more?"

Results

The left eye, that is, the one in which pontocaine was instilled, was more irritated according to 273 patients. No difference in the irritation of the two eyes was noted by 93 patients. In the opinion of 42 patients

* Aided by a grant from The Ophthalmological Foundation, Inc.

† Manufactured by Smith-Dorsey Company, Division of The Wander Company, Inc., Lincoln, Nebraska.

the right eye burned more. It was noted that the group recording no difference in the two eyes consisted primarily of mentally slow, elderly individuals or of patients with a low I.Q.

Of this group 26 stated that the drops did not burn at all. Among the group of 273 patients, 21 stated that the right eye did not burn at all. The comments ranged from "this burns," "no nothing," "the left eye burns a little stronger" to about the same" and "the left eye burns like hell."

Quite a few patients in the glaucoma clinic, realizing that a new procedure was being used, suspected that the left eye had received a new drug because it hurt more, although they had been treated with the same strength solution of pontocaine at all former visits. The examiner occasionally had difficulty in convincing these patients to the contrary.

In evaluating subjective reactions to surface anesthetics, there are several important factors, some of which may be altered. Among these are: (a) individual difference in sensitivity, (b) state of irritation of the eye, (c) percentage of the solution, (d) amount of applied solution, and (e) the method of application.

a. *Individual difference in sensitivity.* It is evident that the range of sensitivity of individuals varies markedly. The great physical and psychologic differences among clinic patients makes a valid comparison difficult. To compensate for the many variable factors which make it difficult to guarantee constantly equal conditions during experiments, a large number of patients were questioned as to their reactions.

b. *State of irritation of the eye.* The degree of irritation of the eye has a definite influence on the subjective reaction as well as on the depth and duration of the anesthesia. The more hyperemic an inflamed eye is, the larger is the blood volume per time unit. Therefore, the anesthetic agent may be carried away before it can reach the effective threshold dosage unless this effect is counteracted by the prior instillation of epinephrine.

c. *Percentage of the solution.* Marx[3] stated in 1932 that the duration of the burning sensation is in direct proportion to the percentage of the solution. This was borne out in the present investigation. When the 0.2-percent solution was instilled in one eye and the 0.4-percent solution in the other, the higher concentration caused more and longer lasting irritation in 21 out of 30 subjects although nine patients noted no difference. All of these tests were done first in the eyes of one of us (R. E.), using pontocaine, 0.5-percent and 1.0-percent, as well as dorsacaine, 0.2-percent and 0.4-percent. The results were the same as in the first group of 21 patients.

d. *Amount of applied solution.* The same bottle containing 0.4-percent dorsacaine was used and the usual dropper employed in the left eye but the right eye was instilled by means of a special dropper (designed by Charles P. Tolman) with a steel tip, which makes the drop so small that 133 drops are obtained from 1.0 cc. of dorsacaine whereas with the ordinary dropper 55 drops of water or 44 drops of dorsacaine are obtained. Of 30 patients all stated that the larger drop produced a more intense sensation of stinging than the smaller drop although both were from the same bottle. Many of the patients were incredulous that it was one and the same drug.

To detect the distribution of the drug over the cornea a series of eyes was medicated with dorsacaine mixed with fluorescein. It was found that a single drop from the Tolman dropper applied at the 12-oclock position on the limbus was sufficient to cover the entire cornea with a film of dorsacaine mixed with fluorescein.

e. *Method of application.* An attempt was made to standardize the technique of instillation. The subject was placed on his back. The lower eyelid was everted and one drop of the solution at room temperature was introduced into the lower fornix without moving the tip of the dropper into the visual line.

Atkinson[4] stated that the margins of the eyelids are richly supplied with sensory nerves and are the most sensitive part of the eyelids. This corresponds with the observation that if the fluid, either because of the presence of an excessive amount of the drug or because of induced tearing, runs over the eyelid margins and touches the cilia, blinking, blepharospasm, and irritation are more pronounced.

An attempt was made to determine the subjective reaction of patients when one eye was held open while the other was closed immediately after a drop of the same solution was instilled in each eye. This was done in 60 eyes of 30 patients. All 30 patients stated that the stinging was less in the closed eye.

III. Potency of the dorsacaine solution

One drop of the 0.4-percent dorsacaine solution was sufficient for taking tension in all patients, except when the eyes were severely painful, for irrigating the lacrimal sac, and for removing superficially attached foreign bodies on the cornea. Embedded foreign bodies required two to three drops. Contact lenses could be fitted after a single instillation (one drop). Gonioscopy could be performed after two applications. Probing of the lacrimal ducts was done with no difficulty after the instillation of two to three drops. Excision of chalazia and the removal of sutures necessitated several instillations (six to 10 drops) at intervals of 30 seconds. It was possible to excise a small pterygium after repeated instillations of dorsacaine (12 to 15 drops).

IV. Rapidity of onset of surface anesthesia

Experiment

The eyes of 85 patients received one drop of dorsacaine (0.4 percent) in the right eye and as a control one drop of pontocaine (0.5 percent) in the left eye. The usual eye droppers were employed with openings two mm. in diameter. The delay between instillations in the right and left eyes averaged four to five seconds and in the final evaluation the time interval was subtracted. The patients were asked to say "now" when either eye stopped irritating them. The time was recorded with a stop watch.

Results

The subjective symptoms described as stinging, smarting, or burning lasted from 0 to 70 seconds for pontocaine (0.5-percent solution) and from 0 to 45 seconds for dorsacaine (0.4-percent solution). In this group 22 persons said that dorsacaine caused no irritation and 13 patients reported similarly concerning pontocaine. The irritation in the remaining 63 cases treated with dorsacaine averaged 9.8 seconds and in the remaining 72 pontocaine-treated cases 23.0 seconds. If the patients who said there was no irritation are included, the duration of irritation for dorsacaine is 7.2 seconds and for pontocaine 19.8 seconds.

V. Duration of anesthesia

Experiment

Sensibility was tested by inducing the corneal reflex. Frey hairs were not used since test experiments, checked by biomicroscopy, revealed that erosions could not be avoided. Therefore, moist cotton applicators, pointed at one end, were applied in a manner as uniform as possible, being well aware that only approximate values could be obtained. The sensitivity of the cornea in the center is 10 times that of the periphery.[5]

In our experiments the tip of the wisp of cotton was always placed tangentially to the corneal margin at the 6-o'clock position. Prior to the instillation of a single drop of dorsacaine (0.4 percent) in the right eye and as a control pontocaine (0.5 percent) in the left eye, the presence of a normal tactile eyelid closure reflex was determined with the same wisp of cotton. The measurements were carried out on 56 patients in a glaucoma clinic containing persons of both sexes and of a relatively high average age. The stimu-

lus was repeated every five minutes until the reflex recurred.

Results

The time in which sensation returned varied widely between 10 minutes and 70 minutes for pontocaine and from 10 to 50 minutes for dorsacaine (0.4 percent). The average time of tactile insensibility for dorsacaine (0.4 percent) was 18.0 minutes and for pontocaine (0.5 percent) 21.3 minutes. It was evident that younger patients in the series and those who were nervous had an earlier return of the reflex than the older more placid individuals. In addition in evaluating results it must be realized that many of the eyes had had one or several glaucoma operations, some of which were recent and included certain procedures which might have decreased the sensibility of the cornea. Therefore, these results would probably not be applicable to the general population.

The duration of anesthesia following the administration of dorsacaine may be shortened by the instillation of saline after the eye has been tested. This procedure would be of value in mass surveys for the detection of glaucoma, especially in industry. However, recently dorsacaine (0.4 percent) has been supplied in plastic bottles which release a smaller drop than the ordinary droppers. The duration of anesthesia produced by a drop from such a plastic bottle was tested in both eyes of 20 young persons with healthy eyes (residents, nurses, and nurses' aides). The time of duration ranged between 4.5 minutes, and 12 minutes, with an average of nine minutes. The examiners had the impression that in younger patients with healthy eyes the duration of anesthesia was shorter.

VI. Systemic toxicity

Witmer's experiments[6] employing subcutaneous and intravenous injections in the mouse, rat, guinea pig, pig, and rabbit revealed the systemic toxicity of dorsacaine (Benoxinate) to be comparable to that of tetracaine (pontocaine). Solmann[7] stated that the toxicity of pontocaine hydrochloride on injection is 10 times greater than that of procaine.

No systemic effects were observed in any case after topical application of dorsacaine or pontocaine.

VII. Local reactions to dorsacaine and pontocaine

Experiment

Among the eyes of more than 600 persons examined, only 26 showed any noticeable hyperemia in previously noncongested eyes, when observed macroscopically, if only one or occasionally two drops of dorsacaine (0.4 percent) were administered in the right eye. Only five of these developed two to three-plus injection of the conjunctiva. Fifty-seven of the eyes treated with pontocaine became from one to three-plus hyperemic. In no case, neither in the dorsacaine nor in the pontocaine treated eyes, was a macroscopically visible lesion or stain in the cornea observed.

To investigate the microscopic effects on the cornea the following method was employed:

Both eyes of 31 patients afflicted with chronic simple glaucoma were stained and checked with the slitlamp to assure the integrity of the cornea. All patients with corneal changes were excluded except cases with arcus senilis. Then a drop of dorsacaine was instilled into the right eye every three to five minutes eight times and as a control 0.5-percent pontocaine was instilled in the left eye at the same time and with a dropper of identical size. The patients were asked to keep their eyes closed between instillations but many of them forgot and opened them. The eyes were stained a second time, rinsed with saline and examined by means of biomicroscopy. After instilling another drop of dorsacaine in the right eye and pontocaine in the left eye tension was taken, and the corneas again stained, rinsed, and examined.

TABLE 1

OCCURRENCE OF CORNEAL STAINING CAUSED BY DORSACAINE AND PONTOCAINE
(Eight drops of each drug instilled at three-minute intervals)

Drug	Number of Eyes Treated	Number of Eyes Showing Stain	Degree of Staining				Number of Eyes Revealing Stain After Tonometry
			0	+	++	+++	
Pontocaine (0.5 percent), left eye	30	29	1	8	5	16	30
Dorsacaine (0.4 percent), right eye	30	17	13	10	5	2	30

RESULTS

Of the pontocaine-medicated eyes 29 showed definite superficial punctate corneal staining, which ranged from a few stained spots to surprisingly extensive areas of staining. If a scale of four grades is applied, only eight fell into the one plus group, five were two plus, and 16 were three or more plus. Of the right eyes into which dorsacaine was instilled, 17 revealed a stain and of these only five were two plus, two were more than two plus, and 10 were one plus. We attempted to document the difference, which was striking and evident for the eye under the slitlamp, but not a single photograph revealed the stained areas clearly enough. The results obtained are tabulated in Table 1.

After tension was taken, no matter how cautious and gentle the technique, there was no eye of the pontocaine or dorsacaine treated groups which was completely devoid of staining. However, it was clearly evident that also after tonometry the damage to the corneal epithelium was significantly less in the dorsacaine-treated eyes. It was not possible to observe the duration of the effect in these cases. In four hospitalized patients, in which the other eye could not be used as a control because of pathology, evidence of corneal damage could still be detected in the case of pontocaine one hour after instillation of the last drop in three cases and two hours later in one case.

In another group of 21 patients one drop of dorsacaine was instilled in the right eye, using pontocaine as a control in the left eye (table 2). Fourteen of the pontocaine-treated eyes revealed staining as compared to six of the dorsacaine-treated eyes. After tonometry five more of the pontocaine group showed one plus staining and six more in the dorsacaine group.

The staining is characterized by multiple tiny greenish dots diffusely scattered over the cornea or, as in most instances, round areas with scalloped circumferences irregularly distributed on the surface. None of the staining areas extended deeper than Bow-

TABLE 2

OCCURRENCE OF CORNEAL STAINING CAUSED BY DORSACAINE AND PONTOCAINE
(One drop of each drug instilled)

Drug	Number of Eyes Treated	Number of Eyes Showing Stain	Degree of Staining				Number of Eyes Revealing Stain After Tonometry
			0	+	++	+++	
Pontocaine (0.5 percent), left eye	21	14	7	8	6	0	19
Dorsacaine (0.4 percent), right eye	21	6	15	5	1	0	12

man's membrane and none of the patients returned with any complications after discharge from the clinic. The temporary damage to the epithelium produced by pontocaine is probably functional and due to inhibition of the dehydrase system. The glycolysis and the cytochromeoxydase system is not disturbed.[1]

VIII. Effect on size of pupil

No special series was studied in order to determine changes in the size of the pupil. However, in no case in this investigation was a significant mydriasis or miosis seen which could be attributed to the instillation of either pontocaine or dorsacaine.

IX. Effect on intraocular pressure

Experiment

The tension of each patient was taken twice and the average used as a base value. It varied between 11 mm. Hg to 56 mm. Hg (Schiøtz). For anesthesia one drop of pontocaine (0.5-percent solution) was instilled in the right eye and one drop of dorsacaine (0.4-percent solution) was used in the left eye. Thereafter, two drops of each drug were administered six times every 10 minutes into the respective eyes. Of 36 patients treated in this manner 19 had chronic simple glaucoma, six secondary glaucoma, three acute congestive glaucoma, and eight patients had diagnosis including uveitis, optic neuritis, chorioretinitis, dacryocystitis, and pterygia. With the exception of the latter group all of them had either been operated on previously or were undergoing treatment with the drugs commonly used for glaucoma, such as pilocarpine, mecholyl (20 percent), prostigmine (5.0 percent), eserine, and diamox. Tension was determined again after one and two hours.

Results

Following the instillation of dorsacaine, tension remained the same in 14 eyes, rose an average of 0.4 mm. in seven cases, and fell an average of 1.8 mm. in 15 cases. These values are a mean of two to three readings after one and two hours. Following the instillation of pontocaine, tension remained unchanged in 10 cases, rose an average of 1.0 mm. in five cases, and fell an average of 2.0 mm. in 13 cases. These values are also a mean of readings after one and two hours.

In no group was there an evident rise or decrease in tension. The apparent slight decrease after an hour and after two hours may be explained by the better co-operation of the patient at this time. The slight fluctuation is considered insignificant and within the limits of experimental error.

X. Influence on accommodation

Experiment

Of patients hospitalized for various kinds of pathology in one eye, who were under 45 years of age, 32 were medicated with two drops of dorsacaine every 10 minutes in the healthy eye after the near-point of accommodation had been determined with the Berens-Duane rule, monocularly with or without correction. A control study using pontocaine could not be made in this experiment because no patients with two normal eyes were available.

Results

After an hour the near-point of accommodation was measured under the same conditions. The changes did not exceed 20 mm. either of approximation or recession of the near-point and are considered within the limits of experimental error.

XI. Allergenicity

The eyes of patients sensitive to pontocaine are frequently anesthetized with holocaine which burns a great deal more than pontocaine. Eleven patients who were sensitive to pontocaine were medicated in the left eye with holocaine and in the right eye with dorsacaine at their regular glaucoma follow-up appointments. All of them stated

that dorsacaine smarted less than holocaine and none showed any untoward reactions on repeated instillations (two to seven times). It is clear that these numbers are not statistically valid, yet it appears likely that dorsacaine may be efficacious in cases of allergy and hypersensitivity to pontocaine, the incidence of which may be underestimated.[3, 8-15]

XII. Summary and Conclusions

The subjective reactions of 408 patients to the instillation of dorsacaine (0.4 percent) were compared with those following the administration of pontocaine (0.5 percent). After the instillation of dorsacaine the sensation of irritation was significantly less than following pontocaine.

The subjective reaction to different concentrations of dorsacaine was studied. The subjective irritation was directly proportional to the amount of the anesthetic and the percentage of the concentration.

The amount of irritation by large and small drops of the same concentration of dorsacaine was compared. The larger drops produced a more intense sensation of stinging.

The difference in subjective reaction in eyes kept open or closed after the instillation of dorsacaine was determined. It was found that the subjective sensation was significantly less when the medicated eye was kept closed after the instillation of the drug. Dorsacaine was evaluated as a local anesthetic for different minor operative procedures in the clinic. In a 0.4-percent solution, dorsacaine may be used for tonometry (one drop), fitting of contact lenses (one drop), irrigation of the lacrimal sac (one drop), removal of superficially attached foreign bodies (one drop), gonioscopy (two drops), embedded foreign bodies (two to three instillations), probing of lacrimal ducts (two to three drops), excision of chalazia (six to 10 instillations), and removal of sutures (six to 10 instillations). If necessary a pterygium may be removed under dorsacaine anesthesia alone (12 to 15 instillations).

The rapidity of onset of anesthesia after medication with dorsacaine (0.4 percent) in the right eye was recorded in 85 patients. Pontocaine was instilled in the left eye as a control. Dorsacaine caused a more rapid onset of surface anesthesia than pontocaine in a 0.5-percent solution.

The duration of anesthesia following the instillation of dorsacaine was slightly less (average 18.0 minutes) than with pontocaine (average 21.3 minutes). It was found that when the amount of the anesthetic was decreased the duration of the anesthesia was shortened. For example, the duration of anesthesia following the instillation of a smaller sized drop of dorsacaine (0.4 percent) from a plastic bottle was nine minutes (an average of 20 individuals).

Systemic toxicity was not encountered following the topical application of either dorsacaine or pontocaine into the conjunctival sac.

Macroscopic observation of over 600 eyes revealed that hyperemia occurred in 26 eyes following medication with dorsacaine, whereas 57 of the pontocaine-treated eyes became injected.

The microscopic changes in the corneal epithelium were significantly less after the application of dorsacaine (0.4 percent) than after the use of pontocaine (0.5 percent). When the cornea was stained, the degree of staining was more evident in the pontocaine-treated eyes than in those in which dorsacaine (0.4 percent) had been instilled. These eyes received eight drops of each solution.

After the application of the tonometer, all eyes (both pontocaine-and dorsacaine-treated) showed some degree of staining.

When only one drop of pontocaine and one drop of dorsacaine were instilled and the cornea stained, the incidence of staining was higher in the pontocaine-treated eyes both before and after tonometry.

Dorsacaine had no essential effect on pupillary size or reactions, tension, and accommodation.

Patients suffering from allergy or sensitiv-

ity to pontocaine may use dorsacaine with advantage.

For mass surveys for the detection of glaucoma, especially in industry, dorsacaine (0.4 percent) may be valuable. It is recommended that (1) the period of anesthesia should be shortened additionally by instilling saline in the eye to be tested, which, because of the rapid onset of anesthesia after instilling dorsacaine, is possible within 15 to 20 seconds; (2) an antibiotic or sulfonamide drug should be instilled for prophylaxis after the tension has been recorded; (3) a dropper releasing a smaller drop of 0.4 percent dorsacaine than the usual dropper or the new plastic dropper bottle should be used to lessen the subjective irritation and the duration of the anesthesia, and (4) the drug should be applied above the limbus and the eye should be closed until the stinging sensation subsides.

These clinical experiments comparing the subjective and objective response of patients to the use of dorsacaine (0.4 percent) and pontocaine (0.5 percent) demonstrate clearly that dorsacaine is less irritating than pontocaine and that it is a most effective surface anesthetic for ophthalmic use.

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OPHTHALMIC MINIATURE

The general properties which render glass so valuable as an optical agent, are easily obtained: but there is one condition essential in all delicate cases of its application, which is not so readily fulfilled; this is, a perfectly homogeneous composition and structure. . . . The irregularity constituting streaks, striae, and waves, is the most difficult to avoid, and the most injurious in its effect. It is not an improvement that is required, but absolute perfection, a homogeneity equal to that of pure water.

Faraday, M.: On the manufacture of glass for optical purposes, *Philosophical Transactions of the Royal Society of London*, **120**: 1-57, 1830.

TOXIC CONJUNCTIVITIS DUE TO ANTIBIOTICS*

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Since the widespread use of antibiotics in ophthalmology, most conjunctival infections have been controlled. Although these drugs have tremendously aided the treatment of conjunctival inflammations, they have greatly increased the number of toxic or allergic local reactions. These reactions may develop immediately after short usage of the sensitizing drug, or in a delayed manner following sensitization of the tissues from prior systemic or local use.

It is now well accepted that antibiotics may produce sensitization of tissue[1] This tissue, after a latent exposure period of days to years, may suddenly develop an inflammatory reaction to various allergens. When this belated type of reaction occurs in the conjunctiva, it may imitate many conjunctival diseases, especially viral infections. In many of these cases differential diagnosis on a clinical basis alone is virtually impossible. It is probable that part of the increased incidence of this reaction is a result of the abuse of antibiotic therapy. This is not only true of the common ocular use of antibiotics locally in abacterial or chronic conditions but also of the prevalent use of systemic antibiotics, especially in small dosage, in the treatment of mild bacterial or viral diseases such as pharyngitis, grippe, mild upper respiratory infections, and so forth. Thus, many unusual conjunctivitides in which a preliminary sensitization is suggested are now being seen.

TERMINOLOGY

Toxic, allergic, anaphylactic, and *hypersensitive* reactions are terms much confused in the literature because of their different usages by pathologists, allergists, immunologists, and general clinicians.

Toxic reaction is primarily a term used in pathology to designate a definite type of tissue change irrespective of whether the cause be chemical, metabolic, viral, or immunologic. A classical example of this is the tissue change of epidemic hepatitis where the liver cells are swollen and show evidence of cytoplasmic injury or necrosis.

Allergic reaction is primarily an immunologic term classically designating a characteristic reaction to a specific protein. This concept no longer entirely holds because physical agents,[2] chemical factors, metabolic products,[3] and even elementary metals[4] have been shown to act as specific allergens. The allergic reaction requires a preliminary sensitization and a later contact with the specific allergen. A classical example of this is the Pirquet reaction.

Anaphylactic reaction is an immunologic term used to describe a specific type of allergic reaction. Classical examples of this are anaphylactic shock and serum sickness. Both of the latter are actually clinical diagnoses.

Hypersensitive reaction is both an immunologic and clinical term. The immunologists use it to define a tissue state where an offending allergen will cause a reaction out of proportion to the causal factors. The clinician uses it to define a clinical state where the reaction has already taken place.[5] Hay fever is a typical example of the latter.

In clinical medicine the term *allergy* is generally used as a synonym for hypersensitivity, although every hypersensitivity is not allergic in nature. Hypersensitivity is the preferable term if the causal factor be unknown, or if the allergen be physical such as cold, heat, or light. Toxic reaction is the preferable clinical term in cases of drug sensitivity. Pathogenetically all are hypersensitive, pathologically all are toxic.

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General immunologic considerations

There are many theories of immunity, the most acceptable being that the immunologic reaction is brought about by the union of antigen and antibody.

It has been suggested that in the immune state a sufficient number of antibodies are circulating in the plasma to protect the fixed cellular antibodies. In allergic states the circulating antibodies disappear so that the antigen-antibody reaction takes place within the cells. Thus a mild or severe anaphylaxis may develop in the presence of antigen due to the liberation of cellular histamine. As a result more complicated reactions such as precipitation, agglutination, and cytolysis usually occur. Antibody formation is influenced by many factors[6] among which are: the nutritional state of the organism, resistance, heredity, and certain physical factors as exemplified by the fall in antibody titer with lowering of the temperature.[7] The exact site of the formation of antibodies is unknown, but probably mononuclear cells are a most important source.[8-9] It may be that the toxic cytoplasmic granules, so characteristically seen in these cells in toxic conjunctivitis, actually represent the precipitations or agglutinations mentioned above. They are certainly more frequently and numerously found, the more severe the toxic reaction.

If the antigen be a simple one, as for example, a pure protein, then one single antibody is formed against it. Thus an anaphylactic reaction between these two is more specific and acute. On the other hand, if the antigen be a complex one as, for example, whole cells or bacteria, then multiple antibodies are formed, one against each antigenic substance in the complex.[10] Thus the toxic reaction to bacterial antigens is much more complex and milder. This is further borne out by the toxic reaction to viruses of varying sizes. The smaller and simpler viruses cause a more severe reaction than the larger and more complex ones such as lymphogranuloma venereum[11] and trachoma. This general principle may well explain the frequently severe toxic reaction to the antibiotics for the latter would be expected to elicit a reaction similar to small viruses or pure protein.

The number of allergens is almost unlimited and reactions to them are quite variable in different individuals because of the inherent differences among individuals and in their tissue reactions. For instance, the many plants causing hay fever may vary from city to city or even from one city block to another.[12-13] The individual variability is also undoubtedly true in the case of toxic reaction to drugs. The resistance of the body may be so great that, though sensitized and exposed to an allergen, the allergic attack may not be initiated. Certain secondary factors when occurring may, however, even in these individuals, precipitate such an attack. Among these are mechanical (foreign body), physical (heat or cold), chemical (light), and finally emotional disturbances.[14] According to Duke-Elder[15] cold, light, and heat are the more important of these and may well act as primary antigens (physical allergy) rather than as secondary factors. The allergic reaction being primarily a neurovascular phenomenon, it is easily understood why individuals with vascular disturbances or labile neurovascular mechanisms are particularly prone to these reactions.[17-18] From this point of view the allergic manifestation may be related to autonomic dysfunction in which the sympathicoadrenal complex is a primary mechanism by which physiologic equilibrium is restored.

Pathology

Typically, the usual toxic allergic response is a fibrinous inflammatory one. On mucous membranes, the fibrinous exudate is often sufficiently abundant to form a microscopically visible pseudomembrane. If the reaction be more severe and tissue necrosis ensues, a true membrane may be seen. Microscopically there is a tendency to necrosis even in the milder reactions. An initial invasion of leukocytes by chemotaxis occurs and the proteolytic enzymes of these cells assist in the lysis

of dead cells. It is known that dead tissue, as well as most bacteria, is an excellent irritant for chemotaxis.[16] If the number of red cells is increased, the inflammatory reaction may be termed hemorrhagic. Many skin allergies (urticaria, erythema multiforme, and so forth) pathologically show extreme vascular dilatation and this hemorrhagic type of inflammation.[12-20]

Later when mononuclear and phagocytic cells predominate, the beginning of immunity is demonstrated. The pathologic picture is much more severe in sensitized organisms than in the nonsensitized.

Observations

For the past several years over 100 cases of toxic conjunctivitis due to antibiotics have been studied both clinically and by means of laboratory procedures. They were divided into three groups according to severity—subacute, acute, and hyperacute. The signs and symptoms were all much the same, differing quantitatively rather than qualitatively. These included sudden onset, redness and edema of the lids, moist eczematoid reaction of the skin of the lids, mechanical ptosis, bulbar and palpebral conjunctival injection, scanty or no purulent discharge, foreign-body sensation, "dryness" of the eyes and even throat, and headache, especially frontal. In spite of the dry sensation, abundant tearing was a most characteristic finding. The affliction was mainly unilateral. In all cases blurred vision was a common complaint. It was due to the exudation of fibrin, the tearing, and, when severer, to the corneal complications.

In cases of subacute toxic conjunctivitis there was mild edema and redness of the lids and conjunctiva. The exposed bulbar conjunctiva was often involved, as well as either or both angles of the palpebral aperture. A milky appearance, representing a fine pseudomembrane, was usually present on the upper tarsal conjunctiva. This latter could be easily overlooked and was best demonstrated by brushing with a dry cotton swab. Follicular or papillary conjunctival hypertrophy were occasionally, though not necessarily, present. No corneal complications were noted.

In cases of acute toxic conjunctivitis the picture was much the same, but more severe. Either follicular or papillary hypertrophy, one of which was usual, was much more marked. Corneal complications were quite common as was enlargement and tenderness of the preauricular lymph node on the involved side.

In case of hyperacute toxic conjunctivitis the most striking symptom at the onset was the copious tearing. Any mucorpurulent or hemorrhagic discharge present was scant. Pain was accentuated both in the eyes and in the orbits, or even extended to the frontal region. The lid edema was sometimes mild, but more often severe, even producing a cyanotic appearance. In some of the more severe cases the lids became so indurated as to simulate an abscess. Pseudomembranes or even true membranes of the tarsal conjunctiva were almost always present. The bulbar conjunctiva was edematous and often even cyanotic in appearance. Later as the membrane or pseudomembrane faded, the papillary or follicular hypertrophy became more prominent and the conjunctiva especially over the upper tarsus became thickened and very rough. Follicles where present were less numerous, but better developed in the lower cul-de-sac and at the borders of the tarsal conjunctiva. In children, especially in those with the so-called "lymphoid diathesis," the follicular reaction predominated. Sometimes this was so marked as to present the appearance of a lymphoma.

The cases of hyperacute conjunctivitis were extremely sensitive to conjunctival scraping and 0.5-percent pontocaine, which was usually satisfactory for the procedure, did not give adequate anesthesia.

Diffusely scattered, fluorescein staining, superficial, punctate spotting was the commonest corneal complication observed. This had a slight predilection for the corneal center. These spots were round or irregular in shape, varied from few to many, and were

small or large in size. They appeared gray under the direct illumination of the slitlamp. This type of superficial keratitis sometimes very closely resembled that associated with allergic staphylococcal conjunctivitis. The secretory activity of the mucosal cells was much reduced as was demonstrated by the sparsity of mucoid shreds. This, in spite of normal or intensified lacrimal secretion, led to a "dry" conjunctiva and cornea.

A few cases were worthy of special mention. In one chronic alcoholic with lowered resistance, a fulminating deep peripheral corneal infiltration with a yellowish color and sharp border developed and went on to corneal perforation in several hours. This was similar in position to other types of peripheral necrotic corneal ulceration in that a clear zone of cornea surrounded it peripherally. While it was not certain that this was due directly to the toxic reaction, the history, clinical picture, and scrapings were all strongly suggestive and the constantly negative cultures added contributory evidence.

One other patient in whom the toxic reaction could not be excluded, in spite of an uncertain history of preliminary sensitization, developed a severe primary necrosis of the bulbar conjunctiva with a rather mild palpebral conjunctival reaction.

While these latter cases are few in number and not conclusively proven due to the toxic reaction, the evidence is strongly suggestive that occasionally severe ocular toxic reactions to antibiotics can be disastrous. Tissue necrosis due to allergic reaction has been shown to occur elsewhere.[21] Further study will be needed to substantiate its occurrence in this type of reaction.

Bacteriology

Bacillus xerosis was almost always found in culture. Conjunctival scrapings from some cases of acute toxic conjunctivitis showed very numerous xerosis bacilli almost like a smear from pure culture. All tests of virulence of this bacillus were negative. It often became temporarily gram negative, but was carefully identified as xerosis bacillus. This was explained as a variation of the organism due to the antibiotics.[22]

A number of yeasts, similar in many respects to Pityrosporum ovale, were commonly found in the conjunctival scrapings. This would be analogous to the common occurrence of overgrowth of resistant bacteria, fungi, or yeast[23, 24] in the alimentary tract of persons on systemic antibiotic therapy.

Besides these yeasts and the Bacillus xerosis, staphylococci and gram-negative bacilli mainly of the nonpathogenic group chromobacterium were most frequently found. Some cases of bacterial conjunctivitis undergoing treatment with local antibiotic became culture negative. With the persistence of the same or other antibiotic local therapy and the onset of the toxic reaction, their cultures became positive, and sometimes abundantly so, to these nonpathogenic organisms.

Cytology

The conjunctival scrapings generally showed a fibrinous inflammation with many heavy fibrin threads. Cellular necrosis, autolysis, coagulation, and proliferation were usual. Karyorrhexis, karyolysis, and basket cells were almost always present. In the early acute stage, when the tissue cells showed necrosis, the predominant cellular response was leukocytic. In the acute or hyperacute papillary conjunctival reaction large monocytes or histiocytes were predominant, while in the acute or hyperacute follicular reaction, the response was primarily in the lymphocytic series. These varied from lymphoblasts to very small lymphocytes. Later, in all cases, a variety of mononuclear cells appeared.

The cytoplasm of young mononuclear cells was dark blue and was often filled with definite granules varying in size from minute to large. These, while mainly basophilic, were sometimes metachromatic. In the latter case they varied considerably in staining reaction. The basophilic granules, occurring so typically in the monocytes, were often large and very

dark and differed from the normal cytoplasmic granules of these cells which were fine and neutrophilic or red purple in color. We limited our diagnosis of toxic granules to these abnormal, large, darkly basophilic granules also found in epithelial cells.

Some of these granules, especially the dark ones, when free or occurring in epithelial cells, were surrounded by a light zone and were highly suggestive morphologically of elementary bodies. Others occurred extracellularly, scattered, in clumps, or in clusters.

Typical basophils or mast cells in a limited number were usually present. Occasionally esoinophils were seen.

It was frequently impossible to identify the many bizarre abortive cells some of which were multinucleated. These abortive cells could have resulted from more rapid maturity of nucleus than cytoplasm and may have indicated a local tissue exhaustion. Considerable cytoplasmic debris due to degeneration was common. There was great variation in the size of the cell nucleus and uneven spreading of the chromatin substances. Mitotic division was seldom found but amitotic division could not be excluded.

Pyknosis of all types of cells was common, with diffuse heavily stained nuclei and thick homogenous nuclear membranes. Basophilic granules were commonly associated with pyknosis of all cells. The cytoplasm of pyknotic neutrophilic cells also was filled with dark basophilic dense toxic granules. They usually were not seen in normal nonpyknotic neutrophils.

Giemsa stain was used throughout this work.

Differential diagnosis

The mechanism of development, the clinical picture, and the cytology of all three types of toxic reaction have many features in common. Considered as one entity, toxic conjunctivitis due to an antibiotic is most commonly confused with the viral conjunctivitides, bacterial toxic reaction, and pure neurovascular phenomena.

The two most common drugs producing toxic conjunctivitis are atropine and the antibiotics. Both occur most frequently in adults. In both, tearing and tissue hyperplasia are more prominent than exudation. In the atropine reaction the lower lid and lower cul-de-sac are more involved and a follicular response is more common. The antibiotic reaction is more evenly distributed and in it the upper tarsal conjunctiva usually shows a papillary hypertrophy and often a pseudo or true membrane. The atropine reaction usually[25] has eosinophils in the conjunctival scrapings and the epithelial cells show an extreme mucosal degeneration in tissue section.[26] This is represented in scrapings by the presence of many goblet cells. On the other hand the antibiotic reaction typically produces many monocytes and basophilic toxic granules. Goblet cells or mucous shreds are scanty. The history of the drug being used, of course, usually makes the differential diagnosis of these two easy.

Some viral diseases of the conjunctiva offer a real problem in differential diagnosis. In our experience quite commonly a catarrhal conjunctivitis not initially cultured is treated with antibiotic, bacteriologically sterilized, but becomes progressively worse due to the onset of toxic conjunctivitis. Such a patient is then sent in for laboratory study with the loose diagnosis of "viral" conjunctivitis. This group usually shows the typical cytologic findings of toxic conjunctivitis mentioned above and responds in a few days to stoppage of the drug, boric-acid irrigations, and cold compresses. It is sometimes hard to convince these individuals to do no more than this for there is often a latent period before improvement which adds to their uncertainty.

Epidemic keratoconjunctivitis in its early stages is frequently indistinguishable from toxic conjunctivitis. It more characteristically produces a follicular response of the chemotic lower lid conjunctiva and of course the rather typical punctate corneal spots appearing between the eighth and 21st day after onset are usually diagnostic. According to

Braley,[27] scrapings from these cases show normal epithelial cells, large and small lymphocytes, and a few monocytes. No basophilic granules similar to those herein described in toxic conjunctivitis have been reported in epidemic keratoconjunctivitis. We are now investigating this point.

The cytologic appearance of Beal's conjunctivitis is similar to that of epidemic keratoconjunctivitis except for the absence of fragile cells in the former according to Braley.[28] Clinically the exudate is more profuse in Beal's conjunctivitis and the tearing is less copious than in toxic conjunctivitis. Beal conjunctivitis is usually bilateral, shows no basophilic granules, and has no corneal involvement.[29]

The bacterial toxic reaction usually exhibits a gradual onset and has a much milder and nonparoxysmal course. In this the cultures are usually positive for the offending organism. Clinical findings suggestive of the specific basic bacterial infection, while somewhat masked, are usually present. In our experiences the staphylococcus is the most commonly found organism causing this. The lid margin ulceration, fissuring at the canthi, marginal staphylococcic corneal infiltrates or ulcers, moderate exudate containing many polymorphonuclear cells, usually serve to differentiate it.

In elderly patients, an acute unilateral process has been reported to develop as a primary neurovascular phenomenon without any prior sensitization.[30] This condition usually appears in patients with labile neurovascular mechanisms. Its onset is often associated with emotional disturbances or with a sudden change in the climatic conditions of the patient's environment. Treating such a condition with antibiotics could lead to serious toxic reactions.

A careful history with date of onset, dates and types of medication, subsequent course, together with the clinical and laboratory findings, usually leads to the correct diagnosis of toxic reaction. With the common use of antibiotics today, one should constantly keep in mind the possibility of this reaction when confronted with a case of conjunctivitis.

Discussion

The diagnosis of toxic conjunctivitis due to antibiotics was made in our cases only after a careful history, clinical examination, and laboratory study. All had the typical syndrome, usually with an abrupt onset at varying intervals after receiving the medication. Some were only diagnosed after a remission on interruption of the antibiotic therapy. All had negative cultures or showed only saprophytic bacteria. All showed significant cytologic findings.

There was a tendency to a seasonal variation in these cases, those occurring in older patients being more common in the winter while those in the young were more common in the spring and summer.

Elderly patients having a marked skin telangiectasia of the face and lids were noted to be especially senstitve to the cold, and usually had a more violent type of toxic reaction when it occurred. The theory that sensitivity reaction is primarily a neurovascular phenomenon is bolstered by this clinical finding.

The onset of the toxic reaction after use of the antibiotic varied from one to two hours to one to two days if direct in mechanism. This suggested previous sensitization. Those cases developing after a latent period of six to seven days suggested the development of tissue sensitization coincident with the treatment of the present illness. It is well known that the conjunctiva takes part in the general sensitization in the body and that sensitizing the tissues of one eye may lead to sensitization of the other or indeed of the entire organism.[31] In a sensitive organism a small amount of antibiotic may produce a violent allergic reaction.

Basophilic granules appeared in every case of toxic conjunctivitis so constantly that they have acquired the name of "toxic granules." The quantity of them was directly proportional to the severity of the process. While

they are not specific and may be seen in other conditions, we have not seen them to this degree in any but cases of toxic conjunctivitis.

The exact nature of these granules is unknown. They are presumably not solely a product of accelerated cell maturation because they can be demonstrated in mature cells of any type including fully differentiated epithelial cells. Possibly they may represent the same substance observed in other tissue cells in cases of general pathologic toxemias,[32] or, as previously stated, they may represent protein precipitation or agglutination resulting from the intracellular antibody-antigen union.

It is well to note the considerable similarity of not only the clinical findings, but also the cytologic picture of toxic conjunctivitis and certain viral conjunctivitides. The changes in the cell nucleus in periods of extreme activity or degeneration require further study. It seems possible to assume that antibiotics activate and mutate nuclear stubstances as well as certain bacteria under favorable circumstances. The possible connection between the mutation of cell nuclei and the origin of the xerosis bacillus is under investigation by one of us (H. F.).

Finally, it cannot be stressed too strongly that the routine use of antibiotics for all types of conjunctivitis should be avoided. The sulfa derivatives and other agents are often equally effective clinically and much less prone to cause toxic reaction. It is a serious error to sensitize unnecessarily an individual to antibiotics in the treatment of some benign catarrhal, allergic, or noninfectious conjunctivitis and thus deny him its life saving effect in a later more serious general illness.

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The authors wish to express their appreciation to Dr. A. Gerard DeVoe for his invaluable advice and co-operation.

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PRIMARY GLIOMA OF THE OPTIC CHIASM*

Report of a case

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Although there is an extensive literature on glioma of the optic nerve and chiasm, and over 660 cases have been reported,[1] there are not many well-documented cases of glioma with onset in the chiasm. In most cases, the tumor originates in the optic nerve within the orbit or, less frequently, within the cranium, and may implicate the chiasm secondarily. It is often difficult to know exactly where the lesion started when it involves the transition of optic nerve into chiasm.

Gliomas are benign, grow slowly, and show no metastatic activity. Considered as a group, gliomas of the optic nerve and chiasm commonly present the following features:[1-4] (1) Axial proptosis without displacement, and with fairly good motility of the globe; (2) primary optic atrophy, and sometimes papilledema; (3) on X-ray examination, enlargement of the optic foramen and, with intracranial involvement, undermining of the anterior clinoids; (4) occurrence in the first decade of life in 75 percent of the cases, and in females predominantly; (5) signs of von Recklinghausen's disease, or neurofibromatosis, such as cutaneous café-au-lait spots and subcutaneous nodules, in one-third to one-half of the cases.[7,10] In many cases exophthalmos is the most prominent sign, and the visual loss is predominantly unilateral.

Martin and Cushing[5] in 1923 drew attention to the glioma that has its onset in the optic chiasm. Here exophthalmos occurs at a relatively late stage, and the visual loss from the beginning is more or less equal in both eyes. There is a progressive and rapid loss of vision and bilateral optic atrophy, and the symptoms remain purely visual for some years. The patients are usually too young for reliable visual fields to be obtained. Hemianopic field defects of a very irregular character have been reported in the literature in this type of case. Late in the course of the growth a variety of findings may appear, traceable to pressure on neighboring structures—the third ventricle, the hypophysis, and the hypothalamus. These disturbances include hydrocephalus, obesity, diabetes insipidus, sleepiness, lethargy, and faulty sex

* From the Brooklyn Eye and Ear Hospital and the Jewish Hospital of Brooklyn. Presented at a meeting of the New York Society for Clinical Ophthalmology, March 7, 1955.

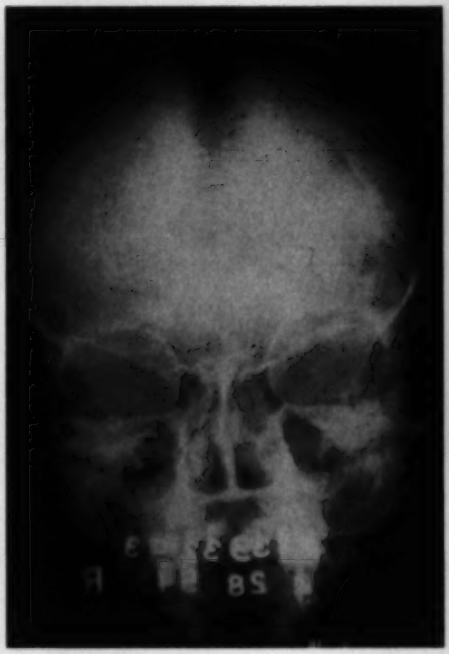

Fig. 1 (Levitt). Posteroanterior roentgenogram, showing sutural diastasis.

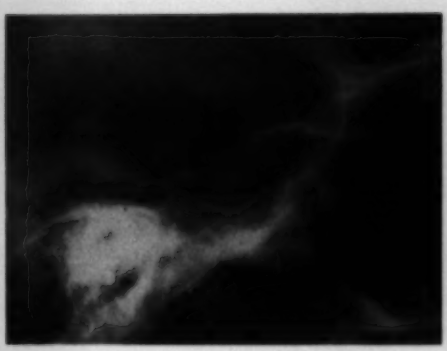

Fig. 2 (Levitt). Slightly enlarged section of lateral roentgenogram of skull, showing pear-shaped sella turcica and undermining of the anterior clinoids.

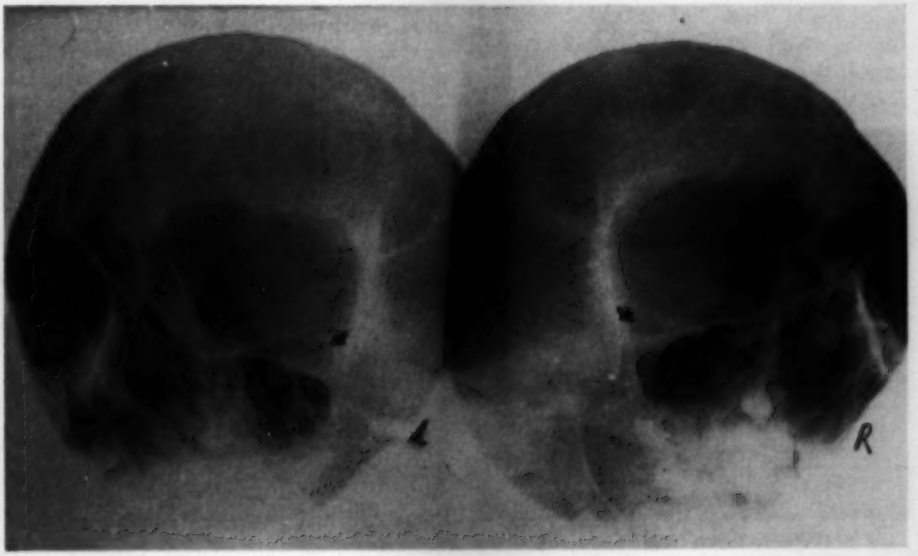

Fig. 3 (Levitt). Bilateral enlargement of the optic foramina.

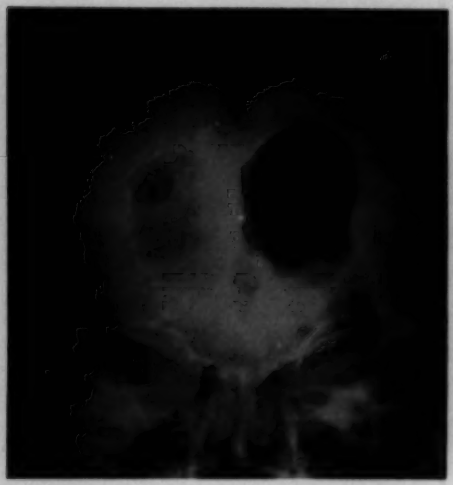

Fig. 4 (Levitt). Ventriculogram—anteroposterior view, showing marked hydrocephalus and flattening of right lateral wall of third ventricle.

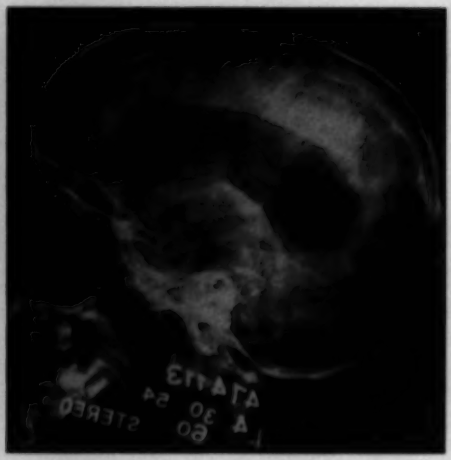

Fig. 5 (Levitt). Ventriculogram—left lateral view, showing tumor mass indenting anterior floor of the third ventricle.

development. If uninterrupted in its spread, the tumor finally involves the base of the brain and the infundibulum, and eventually causes death by mechanical pressure on vital structures. X-ray films show bilateral enlargement of the optic foramina, undermining of the anterior clinoids, and, characteristically, what has been described as a gourd-shaped, pear-shaped, or J-shaped sella turcica. Ventriculography shows dilatation of the lateral and third ventricles with a defect in the anterior aspect of the floor of the third ventricle.

Craniopharyngioma, which also occurs in childhood in the same location, may give a similar type of visual loss. Here the loss of vision tends to be slower; signs of increased intracranial pressure, such as headache and vomiting, are among the initial symptoms; arrested skeletal development, diabetes insipidus, and other signs of pituitary and hy-

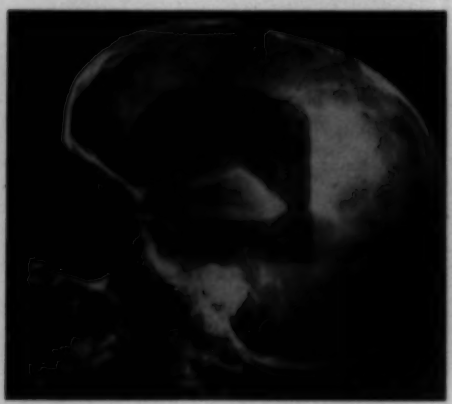

Fig. 6 (Levitt). Ventriculogram—brow position, showing indentation of third ventricle by tumor mass.

Fig. 7 (Levitt). Ventriculogram-tonogram, showing entire extent of tumor (cross-hatched area), lying more to right than left of midline, and undermining of anterior clinoids.

pothalamic involvement may be observed at an early stage; there is no relationship to neurofibromatosis; and suprasellar calcification on X-ray examination is considered pathognomonic.

As to therapy, there is general agreement in this country that glioma of the optic chiasm is not amenable to surgery, as complete removal of the lesion is impossible and mortality is high when operation is attempted. Roentgen therapy is favored as offering the only possible hope of arresting the growth.[6, 8, 9] However, in Denmark numerous authors advocate surgery.

Christensen and Andersen[11, 12] of the University Hospital, Copenhagen, wrote in 1952 that "all tumors of the optic nerve and chiasm are radio-resistant, and the only treatment is surgery." In their six cases of chiasmal involvement, marked improvement resulted from surgery.

Taveras, Mount, and Wood presented a paper in February, 1955, before the Section of Neurology of the New York Academy of Medicine, evaluating X-ray therapy and surgery in 34 cases of glioma of the optic nerve and chiasm treated at the Neurological Institute within the last 25 years. They conclude that X-ray therapy is the method of choice, giving good results in almost all their cases.

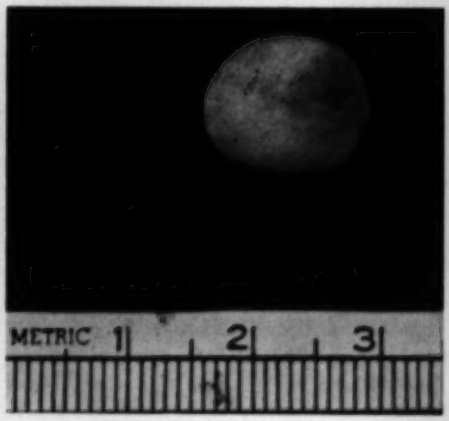

Fig. 8 (Levitt). The gross appearance of the excised lesion.

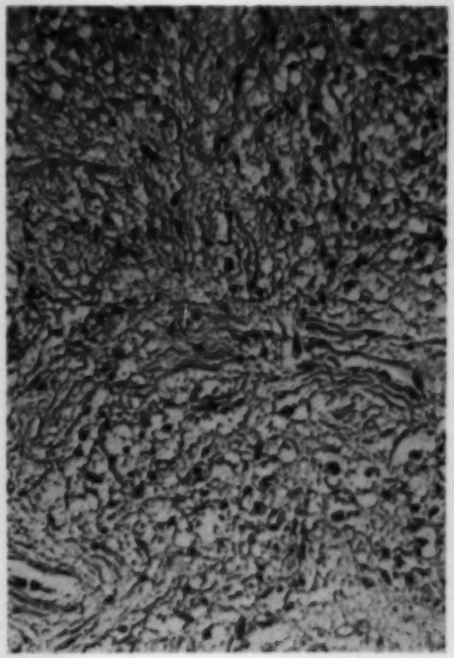

Fig. 9 (Levitt). Photomicrograph, showing character of tumor. (Hematoxylin-eosin, ×150.)

They advise surgery as a preliminary to X-ray treatment in only two circumstances. Where a positive diagnosis cannot be made, surgical exploration is required for verification, but a biopsy is not recommended. Where there is an obstructive hydrocephalus, a by-passing procedure, such as rerouting the fluid from the lateral ventricles to the cisterna magna, is performed.

Case report

History. J. R., a six-year-old white girl, was brought from an upstate city to the Brooklyn Eye and Ear Hospital Clinic (service of Dr. Frank E. Mallon) on April 23, 1954, and hospitalized at the Jewish Hospital of Brooklyn on April 27, 1954.

At the age of one year, she fell out of a high-chair and suffered a head injury. The following day she had convulsions and was kept at the City Hospital for a week. The

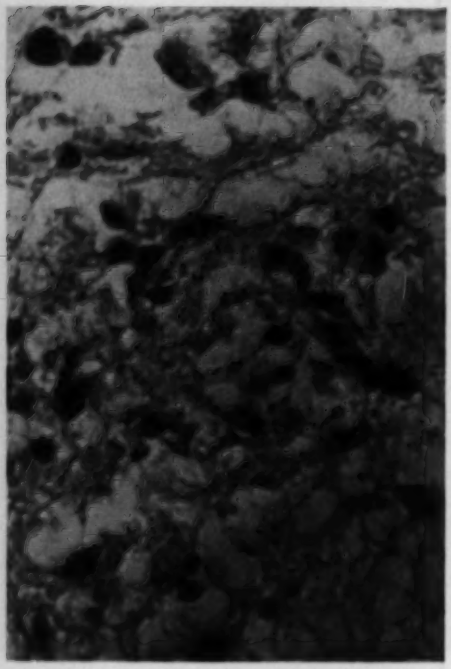

Fig. 10 (Levitt). Photomicrograph of section of tumor under high magnification. (Hematoxylin-eosin, ×400.)

hospital report states that no positive findings were elicited; the ocular fundi were not examined and no X-ray films were taken. At two years of age the child was bumping into closed doors, and the mother was told by an oculist that the eye nerves were "dead." The child steadily continued to lose vision, becoming practically blind three months before visiting the clinic. For the past eight months she had complained of frontal headaches.

Ocular examination. Vision was: O.D., nil; O.S., restricted to a temporal island of vision—hand movements at six inches. There was no exophthalmos. Excursions of globes were unrestricted. The pupils were round, equal, and reacted actively to light, direct and consensually. Media were clear. Both optic nerves presented marked generalized pallor with clear margins; no retinopathy.

Physical examination. The child was attractive, alert, and very co-operative. The only abnormal finding was a positive Macewen's sign (cracked-pot resonance on head percussion). There was no evidence of neurofibromatosis in patient or mother.

X-ray studies. Chest negative. Skull measured 21 cm. in length (large for a patient of this age); sutural diastasis; prominent convolutional markings; pear-shaped sella turcica; narrowing of the posterior portions of the sphenoids; no suprasellar calcification; the optic foramina appeared bilaterally somewhat larger than would normally be seen in a patient of this age.

Ventriculograms revealed marked hydrocephalus involving the lateral ventricles and third ventricle as well.

On tonograms one could identify the aqueduct in normal position, but not the fourth ventricle. The right lateral wall of the third ventricle was perpendicular and a mass shadow could be seen indenting the anterior floor of the third ventricle and grossly distorting the basal cisterns at this point.

Operation. Craniotomy was performed on April 30, 1954, by Dr. A. J. Berman. A right frontoparietal flap which extended across the longitudinal sinus was made and hinged. A tumor in the pituitary region was encountered. It was needled, but no fluid was obtained. The capsule was incised and soft, grayish, gelatinous material was removed with a scoop. Approximately one-half cm. from the capsule surface a hard mass, the size of a small olive, was removed in toto from the sella. The posterior half of the sella could not be seen; the anterior half was completely empty. The pituitary gland was not visualized.

Pathology (Dr. David M. Grayzel). Grossly, the specimen consists of a spheric portion of tissue 1.3 cm. in diameter. The external surface is whitish-gray, and in some areas is pinkish and telangiectatic.

On section, the cut surface is white, moist, smooth, and glistening.

Microscopic study shows a somewhat variegated picture. In some areas there are many fibrillary structures and intertwining bands.

Scattered about are tumor cells that are irregularly polygonal or round and swollen with small nuclei in places eccentrically placed. Elsewhere they assume a pyriform or spindle shape and show delicate fibrillary processes. Scattered among them too are occasional groups of fairly well-preserved ganglion cells. There are also some thick-walled vessels scattered about and around some of them are accumulations of small, round cells. The tumor is a glioma, a fibrillary astrocytoma, arising most likely from the optic chiasm.

Postoperative course. For 10 days the patient had a marked febrile reaction and was disoriented due to subarachnoid and intraventricular hemorrhage. After two weeks she appeared to be completely recovered and was discharged on the 25th postoperative day. One month later she came to the clinic and was reported by her mother to have improved. The eye findings were unchanged from the preoperative examination.

Summary

The clinical findings common to glioma of the optic nerve and chiasm as a group are outlined, and the special features, diagnosis, and treatment of glioma originating in the chiasm are emphasized.

A case is reported of a girl, aged six years, with a history of progressive loss of vision and primary optic atrophy of both eyes manifesting itself at the age of two years and culminating in blindness. The only other symptom was frontal headache of recent onset. Physical examination was negative except for a positive Macewen sign on head percussion. There was no sign of neurofibromatosis. X-ray studies of the skull revealed sutural diastasis, exaggerated convolutional markings, a pear-shaped sella turcica, undermining of the anterior clinoids and enlargement of both optic foramina. Ventriculography disclosed marked hydrocephalus and a large chiasmal lesion indenting the floor of the third ventricle. On operation a tumor mass was removed from the sellar region which proved to be a fibrillary astrocytoma with ganglion cells, originating most likely in the optic chiasm.

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Ophthalmic Miniature

Near this place lies interred the most expert and successful oculist that every was and perhaps ever will be.

Epitaph on Tomb of Dr. Daubigny Turberville,
Salisbury Cathedral.

A COMPARISON OF THE APPEARANCE OF THE VITREOUS

After intracapsular extractions by the Smith and the forceps methods: a preliminary report on 508 cases

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Object of investigation

The object of this investigation was to compare the appearances of the vitreous surfaces after cataract extraction by the two techniques usually used in a series of 508 unselected patients in our annual eye clinics at Shikarpur and Khairpur, Sindh, in the seasons of 1951, 1953, and 1954. These patients were operated on by several different surgeons—some beginners who had done only 60 to 80 extractions previously by the capsulotomy method and some with many thousands of cataract extractions to their credit.

Conditions of investigation

Owing to the tremendous rush of work at these eye clinics, where about 1,600 to 1,700 cataract extractions, intracapsular and extracapsular, are performed annually in addition to about 1,500 other major ophthalmic procedures within a period of eight to nine weeks, only on certain days was there time to examine the aphakic eyes of patients before discharge. At other times, pressure of operating, long ward rounds, out-patient clinics, and other follow-up work prevented this. The majority of patients are illiterate villagers and, even on the days appointed for slitlamp examinations, a proportion of the patients, having received their eyedrops and glasses on discharge, disappeared in their bullock carts without waiting for further examination, which, to them, seemed quite pointless!

Otherwise, all those patients who were ready for discharge on the days for examination were sent to the darkroom, *excluding only those who had actually lost vitreous at operation*. The percentage of vitreous loss in the Smith operation has been reported previously (Holland, H. T., and Holland, R. W. B.: Brit. J. Ophth., Feb., 1949) and amounts to 2.72 percent. The patients, therefore, although not in a continuous series, were entirely unselected, and it was considered that a fair cross section of the total was observed.

Method of investigation

I have tried to be as objective as possible in observing and assessing the results. It is a platitude to say that the worth of any scientific investigation depends on the integrity and accuracy of the observations recorded, but often efforts are made to bolster up an opinion or to refute another by suppressing figures which do not suit a particular theory.

Accordingly, during the first two years of observation, the patients coming to the darkroom for slitlamp examination brought a small slip of paper with them, on which only their case sheet number was written. No indication was given as to what operation was done. The observations were recorded in a notebook and written against the number on the slip. Later in the day the operation notes were consulted to find out whether a forceps or Smith type of delivery had been carried out.

It soon became apparent that a definite pattern of varieties of vitreous surfaces was emerging. These compared very closely to the figures in 1954 when the surgeon's name and the type of operation were also recorded on the slips of paper which the patients brought with them to the darkroom.

Results of investigation

The results were divided into two categories: (a) those eyes in which there was no disturbance of the vitreous surface, and (b) those eyes in which the continuity of

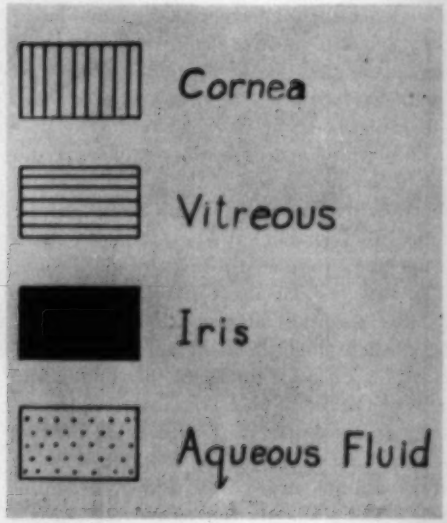

Fig. a (Holland). Key for illustrations.

the vitreous surface had been broken with escape of vitreous fluid into the anterior chamber. Both these groups represent the immediate postoperative appearances of the vitreous surface, as seen on the 10th or 12th day after operation. Further studies are being made on the late appearance of the vitreous surface, and will be published later.

CATEGORY A

1. *Figure 1.* Group A1 showed the anatomically perfect result. The vitreous surface had been disturbed so little that there is a space occupied by aqueous fluid between the iris curtain and the hyaloid membrane. The surface of the vitreous was quite flat, and did not shake at all with movements of the eyeball. In the majority of these cases, iris pigmentation was absent on the surface of the vitreous, and where it did occur, it was sparse.

It is concluded that this group consists of those patients whose zonular ligaments were so friable that the lens dislocated either at the first slight movement of the forceps or at a touch with the Smith hook.

This group comprised 34 Smith deliveries

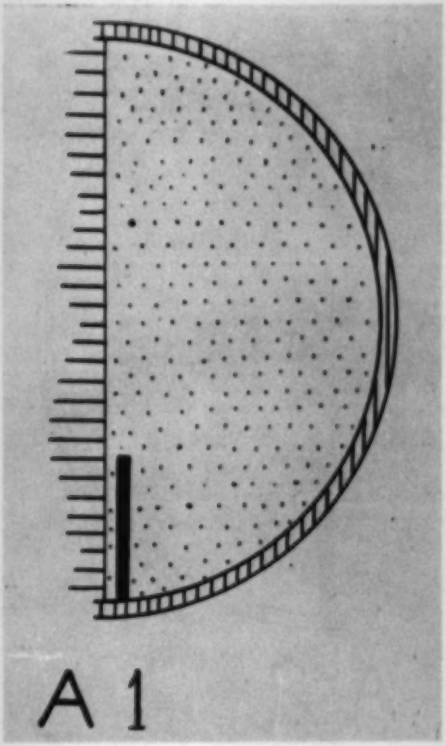

Fig. 1 (Holland). Anatomically perfect result.

(10 percent) and 12 forceps deliveries (7.14 percent).

2. *Figure 2.* Group A2 was the largest group, consisting of 182 Smith deliveries (53.50 percent) and 76 forceps deliveries (45.24 percent). The vitreous surface was quite flat, steady, with no undulations or other irregularities in it. There was no space seen between it and the iris curtain. Pigmentation on the surface of the hyaloid membrane varied from slight to moderate.

3. *Figure 3.* Group A3 consisted of those eyes in which the vitreous surface was flat, as in Group A2, and in which the hyaloid membrane was steady and did not shake with eye movements. But it was differentiated by the fact that the surface of the hyaloid showed several transverse wavy lines running across it, producing shallow, fine undulations, which

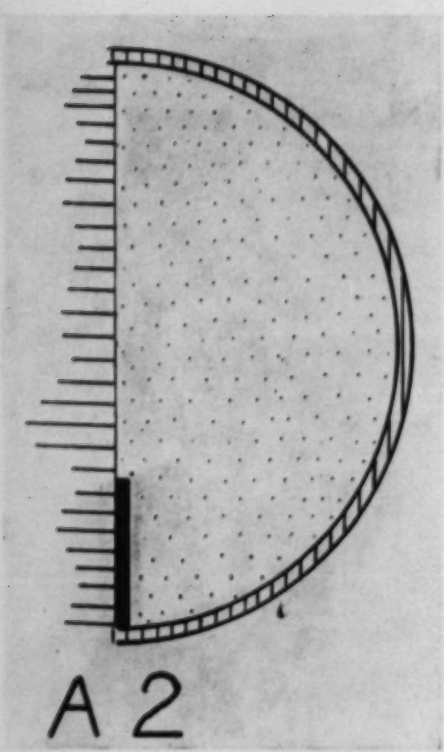

Fig. 2 (Holland). The vitreous surface was quite flat and steady.

gave the appearance somewhat of a washboard such as housewives use. There were nine Smith deliveries in this group (2.64 percent) and 14 forceps deliveries (8.34 percent).

4. *Figure 4.* Group A4 was similar to Group A2 in that the surface was quite flat, but it was observed that the whole surface quivered when the eyeball moved, though there was no bulging or forward surging of the vitreous. The hyaloid membrane was considered to be slightly unstable in this group, which consisted of 13 Smith deliveries (3.82 percent) and nine forceps deliveries (5.36 percent).

5. *Figure 5.* In Group A5, the vitreous surface was quite flat and normal in every respect except one. There was a small, rounded elevation sometimes in the lower part, and sometimes in the upper, which gave the appearance of a shallow bubble. The rest of the surface was quite flat, and showed no quivering or other irregularities. It is possible that this area was inherently weak and might have given way if the zonule had been more tense. There were four Smith extractions (1.18 percent) and two forceps extractions (1.19 percent) in this group.

6. *Figure 6.* Group A6. Where the zonule is tense, a certain amount of distortion must be exerted on the hyaloid membrane in the efforts to dislocate the lens either by the forceps or the Smith hook. In Group A6 the resulting appearance was that of a vitreous which was steady, with a stable surface, which did not surge forward in any way, but which had a slightly convex surface as of a

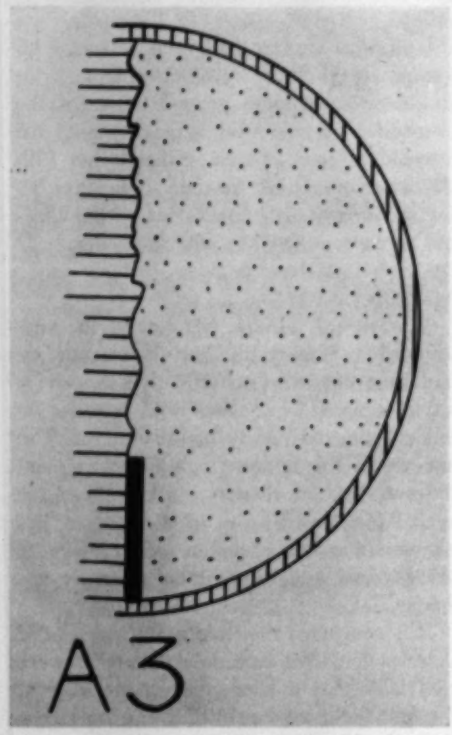

Fig. 3 (Holland). The surface of the hyaloid membrane showed several transverse wavy lines.

shallow watch glass. This represented 40 extractions by the Smith method (11.76 percent) and 17 by the forceps method (10.12 percent).

7. *Figure 7.* Group A7 was the same as Group A6 but the watch-glass bulge was rather more prominent, indicating a still more tense zonule. In this there were four Smith deliveries (1.18 percent) and seven forceps deliveries (4.17 percent).

The total percentages of undisturbed vitreous surfaces thus amounts to 81 percent; 56 percent for the forceps method, and 84.08 percent for the Smith deliveries. The present series was far too small for this to be statistically significant, but it seems as though there is little to choose between either method, as far as one can deduce from Category A.

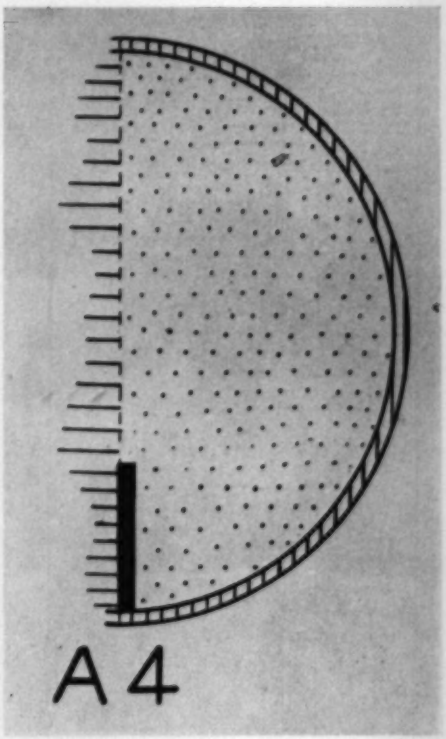

Fig. 4 (Holland). The whole vitreous surface quivered when the eyeball moved.

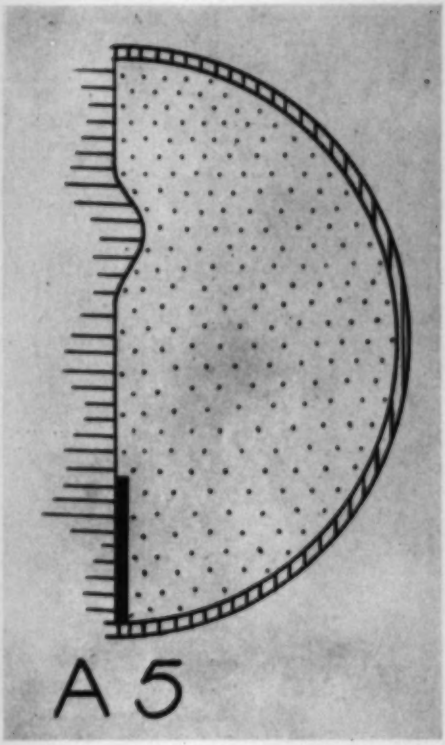

Fig. 5 (Holland). Small rounded elevations gave the appearance of a shallow bubble.

Category B

In this series are included those eyes in which it was discovered by slitlamp examination that some vitreous matter had escaped into the anterior chamber at operation, though it had been unnoticed at the time. In none of these, however, was any vitreous actually lost. In all these eyes the hyaloid membrane had ruptured and the vitreous was prolapsing in varying degrees and in varying places. These all represent an imperfect anatomic result, although the visual result in most of them was excellent.

1. *Figure 8.* Group B1. A bulge of vitreous occurred either laterally or medially, so that it lay over the edge of the dilated iris rim. Smith deliveries represented 11 cases (3.23 percent) and the forceps method, four

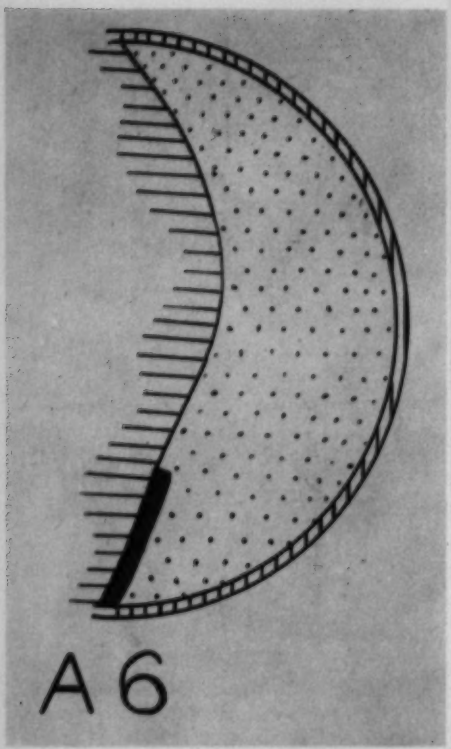

Fig. 6 (Holland). The vitreous had a slightly convex surface, as of a shallow watch glass.

cases (2.38 percent).

2. *Figure 9.* Group B2. The hyaloid membrane was broken superiorly, and the vitreous had prolapsed upward, sometimes in very small amounts, and sometimes so as to impinge on the cornea. Smith deliveries were done in 13 cases (3.82 percent) and forceps deliveries in one case (0.59 percent).

3. *Figure 10.* Group B3. Here there was observed a bulge of the vitreous below, hanging over the lower iris margin when the latter was dilated. The Smith method was used in eight cases (2.35 percent) and the forceps method in five cases (2.98 percent).

4. *Figure 11.* Group B4. In this group the hyaloid had ruptured centrally, and the vitreous matter had bulged out into a little globular mass. Only two cases were encountered in the series, and in neither did the prolapsed mass reach near the cornea. A Smith delivery was done in one case (0.21 percent) and the forceps method was used in one case (0.59 percent).

5. *Figure 12.* Group B5. In these the vitreous had spread like a cloud over the whole of the anterior chamber through a large rupture of the hyaloid. The vitreous was of a fluid nature. Smith extractions were done in 21 cases (6.17 percent), and forceps were used in 20 cases (11.9 percent).

The total percentages of disturbances to the vitreous surface without loss of the substance was, therefore, 18.44 percent for the forceps deliveries and 15.78 percent for the Smith deliveries.

It is interesting to note that the eyes in

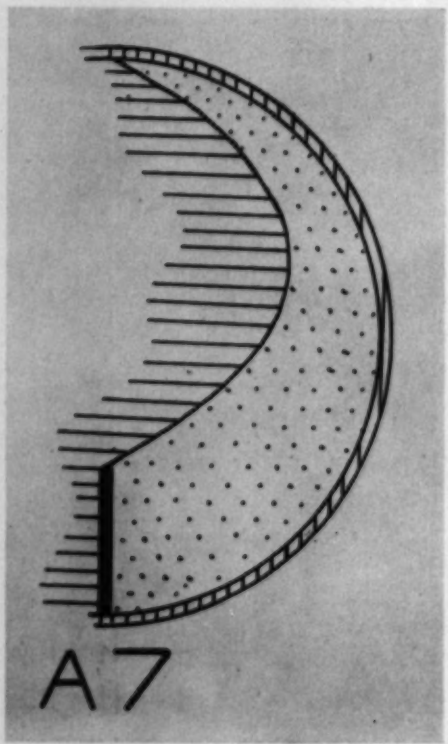

Fig. 7 (Holland). The watch-glass bulge was more prominent, indicating a still more tense zonule.

Groups 1, 2, and 3 of Category B had the advantages of a flat vitreous surface centrally. It would require an enormous and very carefully controlled series of cases to determine whether this group had as good vision as those of Category A; that is, if there were no further subsequent prolapse of the vitreous. It seems that these patients possessed eyes with a relatively strong hyaloid membrane and relatively sticky vitreous. In no case did the vitreous surge forward when the patients moved their eyes up and down, and they were all examined with the iris dilated to the maximum, thus affording no mechanical protection whatever from the iris curtain.

Note on pigment deposit

Pigment deposits were present in about 90 percent of cases. It seemed to be an indication of the tenseness of the zonular ligament. Presumably the stronger the ligament is, the more scattering there is of the small pigment granules from the ciliary body. The amount of pigment was definitely increased in the watchglass groups, Groups 6 and 7 of Category A.

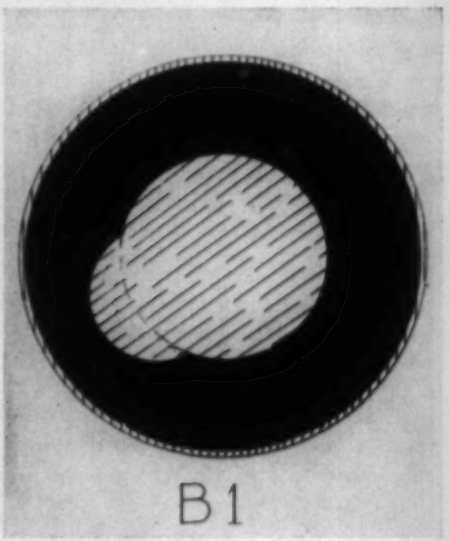

Fig. 8 (Holland). A bulge of vitreous lay over the edge of the dilated iris rim.

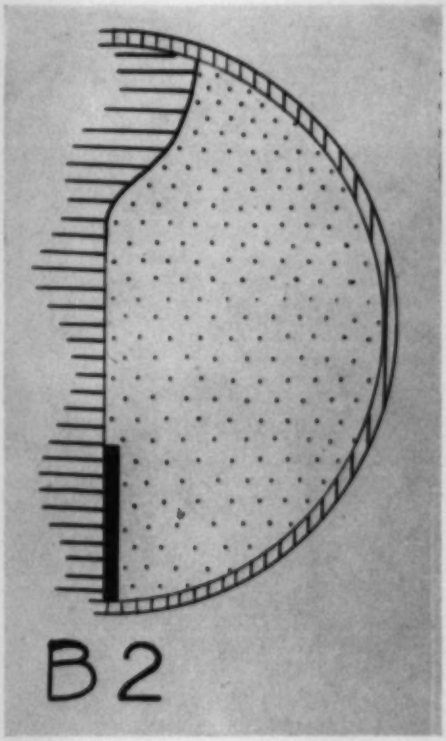

Fig. 9 (Holland). The hyaloid membrane was broken superiorly and the vitreous had prolapsed upward.

Discussion

In our eye clinics, which are attended annually both by inexperienced ophthalmic surgeons, who come from the United States and Britain to learn technique and operative methods, and also by experienced surgeons who come to increase their skill, discussions frequently arise as to the merits and disadvantages of the forceps delivery method of cataract extraction and the other method which is practiced largely at our clinic, that of Smith, modified by Sir Henry Holland.

At Shikarpur, the modified Smith method is practiced as the usual routine, and the for-

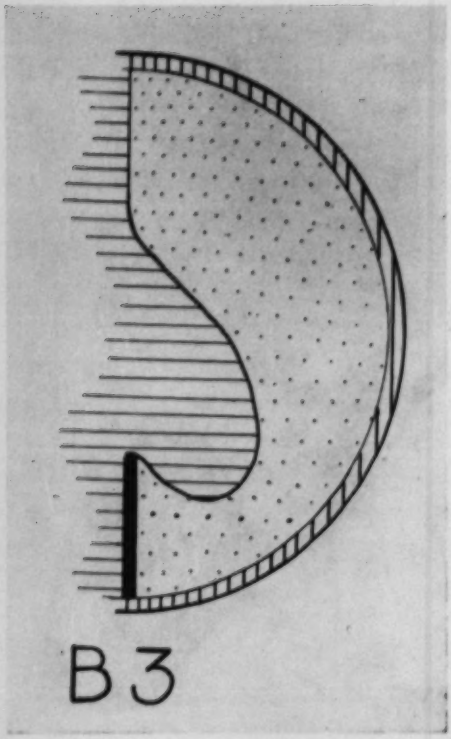

Fig. 10 (Holland). A bulge of the vitreous below, hanging over the lower iris margin when the iris was dilated.

ceps delivery method is also used frequently in order to make the procedure familiar to those who are gaining some skill and wish to acquire more experience in it.

In the past, beyond general impressions, no figures to support the merits or dangers of either procedure have been available, except those concerning the relative incidence of loss of vitreous from the eye. Kirby's figures for loss of vitreous in forceps deliveries varied from three to six percent (*Surgery of Cataract*, 1950), and the figures for the Smith modified procedure were 2.72 percent (Brit. J. Ophth., 1949). Other figures have been published giving higher and lower percentages for the erisophake operation.

Some surgeons have maintained that the Smith method of expression must per se produce more vitreous disturbance than the forceps method. Others have contended equally firmly that the rocking and torsion movements employed in the forceps method have, in fact, resulted in as much or more disturbance to the vitreous face.

It is generally agreed, however, that, other things being equal, *the criterion by which a successful intracapsular operation should be judged is the integrity of the vitreous surface after operation.* The object of the surgeon should be to remove the lens with as little disturbance as possible to the eye as a whole and to the vitreous surface in particular.

The advantages of the forceps delivery are said to lie in the lesser disturbance to the

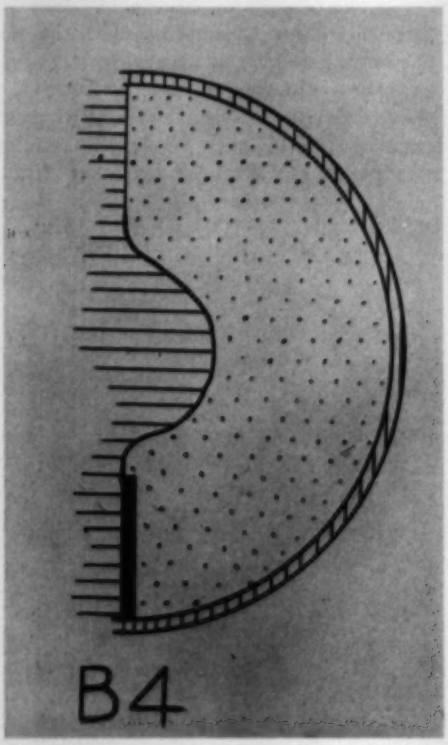

Fig. 11 (Holland). The hyaloid had ruptured centrally and the vitreous bulged out into a little globular mass.

vitreous body because traction is used rather than pressure. But in fact, many operators use the Smith hook or similar instrument to exert pressure on the lower part of the eye to dislocate the lens even though they grasp the lens capsule with forceps.

The disadvantages of the forceps delivery method lie in:

a. The patients must look forward or slightly down to enable the forceps to be applied. In this position of the eyeball the upper part of the vitreous surface is tilted downward and forward, and is more liable to rupture as the lens is being delivered. It can be demonstrated easily and regularly that the vitreous surface settles back and assumes a concave rather than a convex appearance when the patient looks slightly upward.

b. The percentage of burst capsules in forceps deliveries recorded by honest and capable surgeons amounts to as much as 30 percent in some cases, as can be seen by reference to the literature and textbooks.

If those instances are also included where the capsule is so weak and friable that it breaks as soon as it is touched by the forceps, or when the zonule is so tough that the capsule tears before dislocation occurs, the listed percentage would be much higher. These cases are usually listed as capsulotomies, and thus give a false idea of the frequency of burst capsules.

It may be stated here in passing that I have frequently examined lenses that have been removed in capsule by the Smith method, and found that a mere touch of the forceps on the capsules is sufficient to burst them. Some capsules seem to degenerate and are of a jellylike consistency, while others are so tough that one can jerk them up and down several times before they break.

c. If the capsule bursts after the zonular fibers have ruptured, a nasty situation is often encountered, which may result in the vectis having to be used, or in the anterior surface of the vitreous bulging right forward and sometimes bursting with loss of

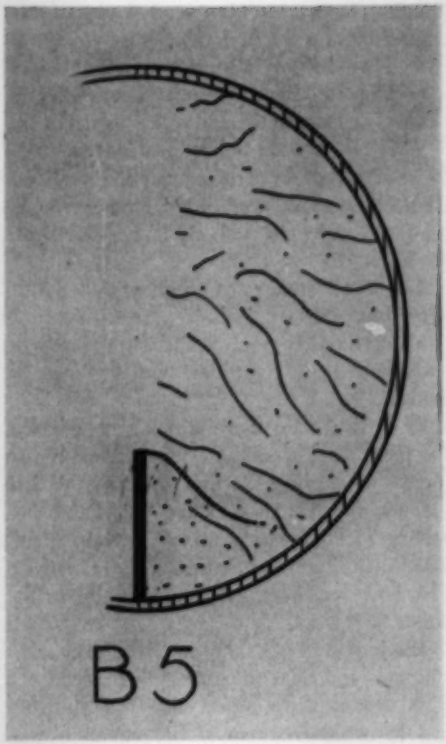

Fig. 12 (Holland). The vitreous spread like a cloud over the whole anterior chamber through a large rupture of the hyaloid.

fluid and subsequent distortion of the surface.

The supporters of the modified Smith method claim that its advantages are:

a. The vitreous surface is, in fact, less disturbed because the patient looks up resulting in the hyaloid membrane settling right back and assuming a concave appearance on delivery of the lens.

b. The percentage of burst capsules is much smaller than with forceps methods, being 6.36 percent (Holland, H. T., and Holland, R. W. B.).

c. If the capsule does burst after dislocation of the lens, then the lens is usually quite easily delivered with the patient looking upward without disturbance to the vitreous surface, as this is tilted back. The re-

maining capsule is then coaxed out of the wound by forceps or irrigation.

d. There is no intraocular manipulation.

e. The modified Smith operation is simple, nontraumatic, and quick to perform.

There are certain indications for and rules to be observed in carrying out the modified Smith procedure, and these have been already defined (Holland, H. T., and Holland, R. W. B.).

The disadvantages of the modified Smith procedure are:

a. It requires more practice to acquire confidence in its execution than the forceps method.

b. It is rather more difficult to replace the iris pillars with the eyeball directed upward. This can be achieved easily by removing the Holland-Fisher hook and inserting a Smith speculum, when the patient looks a little more forward. This maneuver has, however, only very occasionally to be done.

Having stated briefly the ordinary advantages and difficulties of both procedures, it is necessary to repeat that the ultimate test by which they must be judged is the postoperative appearance of the vitreous face. And, from the evidence already shown, it may be concluded that there is very little choice between the forceps and modified Smith procedures in their effect on the vitreous surface.

Summary

1. A series of 508 eyes were examined in the annual eye clinics at Shikarpur and Khairpur, Sindh, in 1951, 1953, and 1954, in order to determine the degree of disturbance to the vitreous surface after intracapsular cataract extractions by the forceps delivery and modified Smith methods.

2. The integrity of the aphakic vitreous surface affords a good criterion by which the two methods may be compared as regards their anatomic results, other things being equal.

3. A short comparison of the other features of the two types of operation is presented.

4. The patients in this series were operated upon both by beginners and by experienced surgeons. More Smith operations were done by beginners than forceps deliveries, and conversely more forceps deliveries were done by those more expert. Thus a relatively fair comparison could be obtained with a slight bias in favor of the forceps deliveries.

5. There was found no significant difference in the appearance of the vitreous surface after either the Smith or forceps delivery. The modified Smith method, as practiced in our clinics, appears to be slightly safer and less damaging to the vitreous both for the beginner and for the more experienced surgeon.

Mission Hospital, Quetta, Pakistan

Ophthalmic Miniature

I find that the whole operation takes from two to three minutes—twenty to thirty cataracts in an hour.

Lt. Col. Henry Smith, I.M.S.

British Medical Journal, September 26, 1903, page 720.

ENZYME STUDIES IN RADIATION CATARACT

JEAN NORDMANN, M.D., AND PAUL MANDEL, M.D.
Strasbourg, France

The Ophthalmological Clinic of Strasbourg has for a long time been interested in X-ray cataracts, but our previous studies had always been based on clinical observations.

Such was the situation when, before World War I, Professor Weill (1919) saw three patients who might be considered as having among the very first cases of radiation cataracts. So it was also, when, in 1931, we were able to ascertain the great sensitiveness of the lens toward X rays. In fact, a young boy, who had received only one administration of nonpenetrating X rays to the scalp, presented a typical bilateral cataract three years later.

Let us also mention that after the publications of Abelson and Kruger (1949) in the United States, and of Dollfus (1950) in France, we examined methodically with the slitlamp the subjects who might have been exposed to the radiations issued from a Cockroft-Walton accelerator. We never detected any cataract.

Today we are leaving completely aside the clinical field. We are focusing our interest on experimental X-ray cataracts; the present study forms a part of our research on the biology of the lens.

These investigations enabled us to conclude that one of the fundamental factors in the formation of lenticular opacities is the breakdown of sugar catabolism. This breakdown can be primary or secondary. It is certainly primary in the experimental diabetic cataract caused by alloxan or ditizon; it is probably so in the galactose cataract. In all these cases the sugar metabolism is altered long before the appearance of the slightest clinical sign in the lens.

In tryptophane deficiency and in the naphthalene poisoning the degradation of glucose very soon becomes abnormal. But we find in both cases early changes of the proteins which lead us to ask whether the primary failure is to be located in the protein or in the sugar metabolism. The question has not yet been answered, but we can suppose that in tryptophane deficiency the glucides are injured after the proteins.

In tetany the secondary character of the deficiency in sugar catabolism is certain; it is produced by a fall of calcium in the blood, in the aqueous humor, and in the lens.

The research on complicated and on cold cataract confirms the pathogenic part played by sugar catabolism, but the situation seems to be different in the X-ray cataract and in the microwave cataract. We shall leave this last aside and make a survey of the studies dealing with X-ray cataract metabolism.

Taliercio (1939) was the first to study the problem of metabolism in this form of opacity. He determined with a Warburg flask the respiration and anaerobic glycolysis of irradiated lenses; he did this before and after the appearance of cataract, but never before three weeks.

He could not find any significant change in respiration, although the glycolysis of the cortex was diminished. It was noted, however, that this modification of the glycolysis was more distinct in clouded than in transparent lenses and that it increased with the evolution of the opacity. Under such circumstances Taliercio (1939) did not feel entitled to assign to the fall of the anaerobic glycolysis a part in the genesis of cataract.

The research on the metabolism of the irradiated lens was resumed in 1950 by Kinsey who determined the turnover of the proteins. He did not find any change in comparison with a normal eye, either a few days after the exposure to X rays, or after the appearance of the first peripheral opacities. It was necessary that the cataract fill three quarters of the posterior area before a noticeable fall of the turnover could be observed.

At the same time von Sallmann and Locke

(1951) were studying the penetration of radiophosphorus into the X-rayed lens. They noticed that in the early stages the radioautographs are unaltered, the almost complete suppression of the exchange in the cortex happening only in advanced cataract. So they inferred that the experiments with radiophosphorus do not support the hypothesis that there is an alteration of the metabolic activity in newly irradiated lenses.

The results of the investigations on the metabolism of the lens reported by Puntenney and Shoch (1953) at the fourth Conference on Radiation Cataracts are not very different. These authors point out that the electrophoretic pattern of the protein is unaltered until important opacities are constituted, that aldolasic and catalasic activities do not fall immediately after a 4,000 r irradiation and that 90 to 120 minutes after such a treatment the ATP and phosphocreatine metabolisms, studied with P^{32}, are found to be normal. Moreover the observations recorded in 1953 by Kinsey on the ATP-fructose-and-pentose-concentrations in the epithelium of lenses irradiated 17 hours to five days before could not be confirmed by Kinsey and Wachtl (1954). We in Strasbourg noted normal concentrations of ATP three weeks after exposure to X rays.

Vitamin C does not change before or after the appearance of cataract. Pirie, van Heyningen and Boag (1953) and Kinsey and Wachtl (1954) agree on this point. They agree, too, on the fact that there is no fall of glutathione in the first days. But the English authors insist on the decrease of the tripeptide during the weeks following the irradiation; this decrease may reach 13 percent before the appearance of the first clinical signs and continues with the development of the opacity. Concerning the glutathione-reductase they observe that the activity diminishes when the first lenticular alterations appear; the sulfhydryl groups of proteins follow a little later but never as clearly as glutathione. Finally they assert that the enzymatic activity connected with the presence of SH-groups diminishes in the cataract, sometimes quite early, whereas the enzymes independent of SH groups are not affected. Thus in the cataract triosephosphate-dehydrogenase, glyoxalase, acetaldehydeoxidase had lost their activity, while the activity of the malic-enzyme, of the isocitric-dehydrogenase, of the lactic-dehydrogenase, and of the cytochrome-reductase was not altered and that of aldolase only in advanced opacities.

Let us not forget that the concentration of the coenzyme-A and of nicotinic acid is lowered during the evolution of cataract, as well as the weight of the lens. This last tendency is reversed only when the cataract becomes intumescent.

What is to be retained of those numerous observations on the metabolism of the irradiated lens? If we really want to apply to the X-ray cataract the same tests we use for the other forms of opacities, if we insist on the breakdown of the metabolism before the appearance of the first clinical signs, we have to consider only the research of Taliercio (1939) on the anaerobic glycolysis, and that of Pirie, van Heyningen and Boag (1953, 1954) on glutathione. But we must remember that in Taliercio's observations the fall of the glycolysis in transparent lenses was always insignificant, so much so that the Italian author did not assign to it any pathogenic part, and that in the experiments of the English authors the fall of glutathione was noticed only three months after the irradiation. Under such circumstances we are obliged to infer that, from the pathogenic point of view, the X-ray cataract cannot be placed among the other opacities. In the present state of our knowledge it would seem to be an exception.

But is it really so? After the failure of our ATP measurements, we wondered if our techniques were accurate enough to detect the initial injuries, located in the epithelium. We have tried for more than a year to work out a method enabling us to point out the fall in the concentration of ATP in small quantities of

lenticular epithelium. This research is still in progress.

On the other hand, we thought it would be of interest to study the enzymes of irradiated lenses, and especially the enzymes of glycolysis with which we are getting well acquainted. But then we at once had to answer two questions: choice of the enzyme and choice of time for examination.

For the first one: choice of the enzyme, we may refer to our own experiments. We found indeed that aldolase and triosephosphate-dehydrogenase of the lens are fairly unaffected by the activators and inhibitors usually studied, such as cations, cysteine, glutathione, whereas ATPase and above all hexokinase are more sensitive to the same factors. We therefore preferred hexokinase and ATPase, and we gave up aldolase and triosephosphate-dehydrogenase which had been selected by other research workers. We feel the more justified in our choice, since the study of the two lenticular enzymes, hexokinase and ATPase, had given us most interesting results in experimental diabetes with alloxan or ditizon, and since the research of Mandel and Rodesch (1955) in the Institute of Biological Chemistry of Strasbourg had made it clear that there are important changes in the hexokinasic activity in irradiated skin.

The same investigations on the skin allowed us to answer the second question, concerning the time of the investigation.

The authors in Strasbourg had, in fact, noticed that the enzymatic activity already slow on the second day, goes through a minimum four days after the exposure. So, in a first group we watched the early alterations from the second to the fourth day. In a second series all the animals were killed more than four days after the X-ray administration.

Methods

Irradiation technique

The experiments were performed on adult rabbits which were all subjected to the same type of irradiation technique; they were exposed to a single dose of 1,400 r of penetrating roentgen rays. The radiation factors were as follows: 220 kv.; 12 ma.; 70 r per minute; 3 mm. Al filtration; 30 cm. target-skin distance; 20 mm. field (round). The animals were fastened to the board so that the right eye of each rabbit could be irradiated, while the left eye, shielded, remained outside the beam. The roentgen ray was directed from above and the upper limbus was centered in the field. An operator continuously watched the animal's head.

Clinical aspects

Repeated observations of the lens with the ophthalmoscope and with the slitlamp were made at intervals from 24 to 48 hours during the first days and from two to three weeks in the long-range experiments.

In the early stages we never noticed any modification of the lens. After a latent period of 35 to 50 days the first changes appeared; they were quite similar to those described by Cogan and Donaldson (1951). Only once, in an experiment on hexokinasic activity 113 days after the exposure, were the cataracts complete and the cortex liquefied.

Biochemical methods

The animals were decapitated, the lenses quickly removed, the cortex separated from the nucleus and crushed at a temperature of 0°C.

The measurements were made simultaneously on the irradiated and on the homologous lens, used for control. Manometric techniques were used and the production of CO_2 was checked every three minutes. The results are given in μM of CO_2 per 100 gm. of fresh weight (figs. 1 and 2).

To ascertain the ATPase activity we worked on the homogenates of one normal and one irradiated lens. The method we used is based on the principle that the lens-ATPase liberates phosphoric acid from added ATP; this phosphoric acid drives CO_2 out of the bicarbonates.

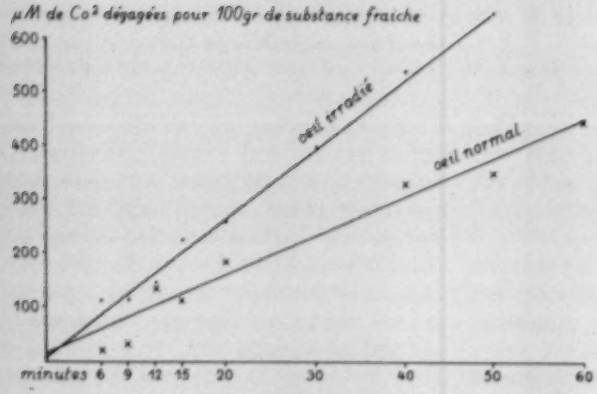

Fig. 1 (Nordmann and Mandel). ATPase activity of the rabbit lens.

We had previously established that the enzyme we found in the lens is first of all an ATPase and not an apyrase.

In order to determine the hexokinasic activity the homogenates (corresponding in each experiment to three irradiated lenses on one side and to three homologous lenses on the other side) were treated several times with acetone at $-10°C$.

The treatment with acetone has for its object the inactivation of ATPase; the addition of sodium fluoride heightens this effect. The liberation of CO_2 is the result of an acid function which appears at the moment when, under the action of the lenticular hexokinase, a transphosphorylation from ATP to glucose takes place.

Results

The detailed results are given in the tables 1 to 4. The enzymatic activity is calculated from the graph determined by all the experimental points obtained during 20 minutes for the hexokinase, during 30 minutes for the ATPase.

The hexokinasic activity is considerably lowered during the first days following the exposure (table 1). This result agrees perfectly with that obtained on the skin by Mandel and Rodesch (1955), but for the lens it has to be pointed out that a fall in the hexokinasic activity is found more than 100 days after the administration of X rays (table 2).

Let us note that marked variations exist in the values of the nonirradiated control lenses; they are due, no doubt, to the very different ages and strains of our laboratory animals. This explanation seems the more justified, since the enzymatic activity of rats of the same stock and the same age varied within rather narrow limits.

Our conclusions are based on a compari-

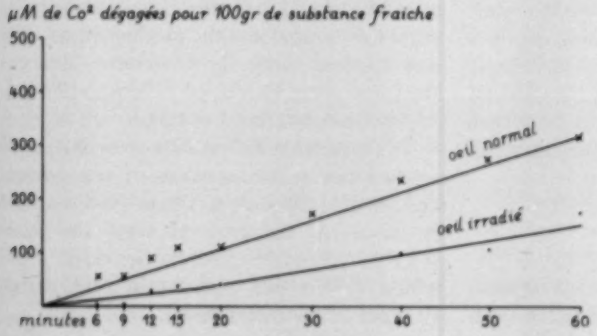

Fig. 2 (Nordmann and Mandel). Hexokinase activity of the rabbit lens.

TABLE 1

HEXOKINASE ACTIVITY IN THE RABBIT LENS
(values in μM of produced CO_2 per 100 gm. of fresh weight after 20 minutes)

GROUP 1

Experiment	Days after Exposure	Irradiated Eye (1400 r in a single dose)	Non-irradiated Eye (Control)	Difference in Activity (percent)
1	2	12	52	− 77
2	2	37	112	− 67
3	2	0	70	−100
4	4	12	102	− 88
5	4	55	87	− 37
6	4	15	50	− 70
7	4	10	75	− 87

TABLE 2

HEXOKINASE ACTIVITY IN THE RABBIT LENS
(values in μM of produced CO_2 per 100 gm. of fresh weight after 20 minutes)

GROUP 2

Experiment	Days after Exposure	Irradiated Eye (1400 r in a single dose)	Non-irradiated Eye (Control)	Difference in Activity (percent)
1	103	100	145	− 31
2	108	55	115	− 52
3	113	0	55	−100
4	113	10	55	− 81

son between the two lenses of the same subject. The lenses were treated in a strictly identical way so that irradiation alone explains the big difference between them. In normal rabbits the difference in hexokinasic activity between equally treated lenses of the same animal after 20 minutes does not exceed 25 percent.

The changes in the ATPase activity were also determined by a comparison between the irradiated and nonirradiated lens of the same animal. So there is no need to retain the variations of the controls. In the normal rabbit the difference in ATPase activity between the right and the left eye is, after 30 minutes, not more than 25 percent.

With two exceptions, among seven experiments, we found the ATPase activity increased during the first days following the irradiation (table 3). This result agrees with the observations of Ashwell and Hickman (1952), but later on the differences are no longer consistent (table 4).

TABLE 3

ATPASE ACTIVITY IN THE RABBIT LENS
(values in μM of produced CO_2 per 100 gm. of fresh weight after 30 minutes)

GROUP 1

Experiment	Days after Exposure	Irradiated Eye (1400 r in a single dose)	Non-irradiated Eye (Control)	Difference in Activity (percent)
1	2	300	85	+254
2	2	380	235	+ 64
3	2	210	145	+ 45
4	3	270	270	0
5	3	395	230	+ 73
6	4	285	150	+ 90
7	4	330	280	+ 18

DISCUSSION

The modifications of the hexokinase and ATPase activities in the cortex reveal a deep alteration of the lenticular metabolism. We submit that a fall in the hexokinase activity is a proof of a breakdown of the sugar catabolism. On the other hand the stimulation of the ATPase activity brings a consumption of the available energy. These two effects—additive during the first days after the exposure to X rays—may have a repercussion on the metabolism of the proteins.

The changes we have observed occur earlier than the fall in the concentration of glutathione and the enzymatic activities reported by Pirie, van Heyningen and Boag (1953) and earlier too than the slowing

TABLE 4

ATPASE ACTIVITY IN THE RABBIT LENS
(values in μM of produced CO_2 per 100 gm. of fresh weight after 30 minutes)

GROUP 2

Experiment	Days after Exposure	Irradiated Eye (1400 r in a single dose)	Non-irradiated Eye (Control)	Difference in Activity (percent)
1	7	150	175	−14
2	8	250	230	+ 8.5
3	65	300	170	+77
4	68	265	260	+ 2
5	69	395	235	+68
6	70	240	265	− 9.5

down of protein turnover noted by Kinsey (1950). They are even evident long before the appearance of the first clinical signs.

Conclusion

The exposure of the lens to a single dose of X rays (1,400 r) brings on a temporary increase of the ATPase activity and a decrease of the hexokinase activity which persists long after the irradiation.

These two facts allow us to conclude that the sugar metabolism is deficient at a very early stage after the exposure to the X rays.

This leads us to assert that from a pathogenic point of view the X-ray cataract is not to be considered as an exception.

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Ophthalmic Miniature

I first tried this remedy (feeding of fresh bovine retinas, 6-10 a day; the extract was called "opticine." Ed.) in retinitis pigmentosa, for it was in connection with that disease that the idea first developed in my mind. I have used it in five of these cases, and in every one of them there has been very distinct and real improvement.

Robert W. Doyne,

British Medical Journal, September 24, 1903, page 725.

COMPARATIVE TONOGRAPHIC STUDY OF RIGHT AND LEFT NORMOTENSIVE EYES*

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A statistical study by Holst[1] initiated some discussion as to the question whether glaucoma may affect the left eye more often or earlier than the right eye. In 1948, one of us[2] proposed a tentative explanation for Holst's cautious statement that the left eye might be more prone to glaucoma than the right: "While the right innominate vein is shorter and straighter, the left one takes a longer and more bending way to reach the vena-cava-superior union. Therefore, differences in blood pressure and resistance can be expected. It is possible that intravascular venous pressure is, at least in some persons, higher in the left orbital veins than on the right side; this could cause a relatively higher pressure in the episcleral and in the aqueous veins of the left eye. Similar considerations may be helpful in explaining differences of intraocular pressure and intravascular pressure suggested to exist between normal right and left eyes."

In the discussion of this note[3-5] doubts were uttered as to the validity of the statement that the left eye should be more prone to glaucoma than the right. Statistical evaluation of the data offered by Holst[1] and by other authors,[3-5] led us[6] to the conclusion that the odds were very great against mere chance being the explanation of Holst's findings of predilection of the left eye for onset of glaucoma while the other figures did not indicate any bias. Holst's cases appeared to be very carefully observed and classified and comprised a very large number.

If glaucoma does occur more often or earlier in the left than in the right eye, then we should expect some differences between right and left eye in anatomic structure or in neurovascular integration. To our knowledge, nothing has ever been published to indicate anatomic differences between otherwise normal right and left eyes. In the course of extensive tonographic study on normal eyes, one of us (B. B. C.) suggested approaching the aforementioned problem tonographically. Previous investigators,[7-9] using the Schiøtz tonometer or the dynamometer, found definite suggestions of higher intraocular pressure and intraocular-vascular pressure in the left eyes of normotensive persons.

Hankla,[10] in a recent study of 6,496 males and 3,457 females, 89 percent of whom had unquestionably normal eye pressure readings, found that ". . . the eye more frequently having the greatest tension was the left."

Since the advent of the electronic tonometer, tonographic readings enable us, not only to ascertain the eye pressure proper, but also to calculate the production of aqueous humor and the facility of its outflow. Functional differences, otherwise overlooked, might now be ascertained by use of this method.

Personal investigations

Two hundred and 43 normal eyes of 128 persons were studied, 122 right and 121 left eyes; the age of our subjects ranged from 49 to 92 years; 101 were Caucasians and 27 Negroes; 58 were female representing 112 eyes, 55 right and 57 left; 70 persons were male, representing 131 eyes, 67 right and 64 left.

Tonography was performed with the Mueller electronic tonometer, without re-

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cording attachment; readings were taken every 30 seconds for four minutes. For determination of the facility of outflow (c) and the amount of aqueous humor produced, we used the formulas applied in a previous publication by one of us;[11] our technique was the same as recently described by Stepanik.[12] The lids were kept separated by means of a light nonmagnetic speculum while the tonometer was in use.

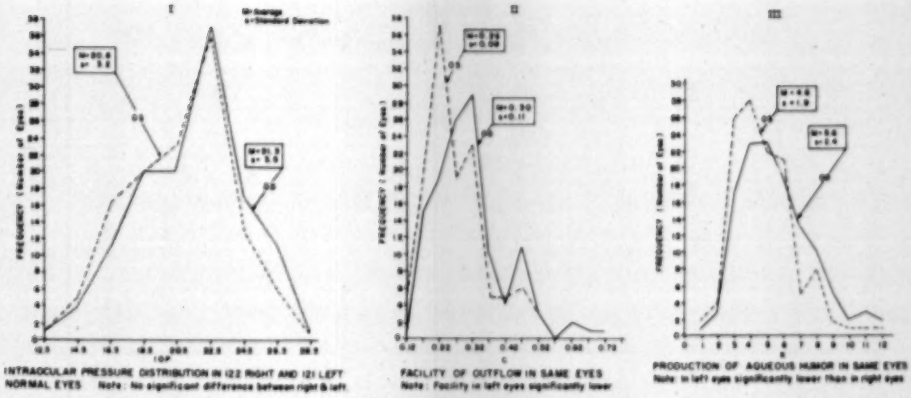
The significance and interpretation of the values obtained by tonography have been sufficiently discussed by Moses and Bruno,[13] Grant,[14, 15] Friedenwald,[16] and by others so that we may omit further explanation.

All our readings were analyzed according

TABLE 1

DISTRIBUTION OF INTRAOCULAR PRESSURE, C AND K FOR ALL RIGHT AND LEFT EYES

O.D.						O.S.					
IOP		c		K		IOP		c		K	
x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)
12	1	0.10	1	1	1	12	1	0.10	1	1	2
14	3	0.15	9	2	3	14	3	0.11	2	2	4
15	1	0.16	2	3	17	15	2	0.13	1	3	26
16	7	0.17	1	4	23	16	5	0.14	1	4	28
17	4	0.18	1	5	23	17	11	0.15	9	5	22
18	17	0.19	2	6	19	18	15	0.16	2	6	21
19	3	0.20	11	7	13	19	5	0.18	4	7	5
20	17	0.21	1	8	10	20	20	0.19	3	8	8
21	3	0.22	3	9	5	21	3	0.20	23	9	2
22	14	0.23	2	10	2	22	18	0.21	2	10	1
23	23	0.24	2	11	3	23	18	0.22	1	11	1
24	2	0.25	4	12	2	24	3	0.23	7	12	1
25	15	0.26	11	16	1	25	10	0.24	4		
26	1	0.27	5			26	3	0.25	3		
27	10	0.28	3			27	3	0.26	8		
28	1	0.29	3			28	1	0.27	2		
		0.30	17					0.28	3		
		0.31	5					0.29	3		
		0.32	2					0.30	20		
		0.33	4					0.33	3		
		0.34	1					0.36	1		
		0.35	1					0.38	3		
		0.36	3					0.39	1		
		0.37	1					0.41	3		
		0.38	2					0.43	1		
		0.39	3					0.44	1		
		0.41	1					0.46	4		
		0.42	1					0.48	2		
		0.43	1					0.51	1		
		0.44	1					0.53	2		
		0.45	5								
		0.46	3								
		0.47	1								
		0.48	1								
		0.49	1								
		0.50	2								
		0.52	1								
		0.61	1								
		0.64	1								
		0.69	1								
		0.70	1								
Total	122		122		122		121		121		121
Aver.	21.3		0.30		5.6		20.6		0.26		4.8
s^2	12.2		0.013		5.81		10.6		0.0090		3.77
s	3.5		0.11		2.4		3.2		0.095		1.9



Figs. 1 to 3 (Boles-Carenini, Buten, Spurgeon, and Ascher). Comparative tonographic study of right and left normotensive eyes. A predilection of left eyes for glaucoma could be explained by their relatively higher resistance to aqueous outflow.

to statistical methods: first the values of all right and left eyes studied were compared, then the same was done grouping the values according to sex.

Table 1 shows the values for intraocular pressure (IOP),* facility of outflow (c), and aqueous humor production (K) for all the right and left eyes; f means the absolute frequency; at the end of the columns appear the average values (M), the standard deviations (s) and the variances (s^2). In Figures 1 to 3, these data are presented graphically, the abscissas corresponding to the tonographic values, and the ordinates to the relative frequencies.

To ascertain the significance of the differences of the variances which we obtained, we applied to these values the F test of Snedecor at the five-percent level of probability.

Table 1 contains the results needed for comparison of the variances. Since the F limit is 1.36, we can conclude that the difference of the variances is significant in the two last series of frequency but not in the first; in other words, there is no significant difference between the intraocular pressures for the right and left eye, but the differences for the facility of outflow and for amount of aqueous humor production are significant. For the right eyes, facility of outflow and aqueous production are significantly higher than for the left eyes.

This result was subjected to another analysis, using the t-test, and the previous conclusions were corroborated.

Table 2 contains the eye pressure, facility, and production values of the right and left eyes of the female subjects; the abbreviations are the same as in the foregoing tables.

Table 2 again permits a comparison of the variances of the female groups. Since the critical F at the five-percent level for this number of cases is 1.57, none of the differences of the variances in this group is significant. In other words, the differences of

* This footnote added since preparation of the manuscript: It has come to the authors' attention that "frequently the I.O.P. of the second eye decreases . . . while tonography is being performed on the first and occurs whether left or right eye is used first. The cause of the effect is unknown . . ." (Ballintine, Clinical Tonography, p. 31, Cleveland, 1954).

When this work was started we performed a certain number of tonographies on the right eye first. Later, and for the great majority of our subjects, we alternated the eye measured first and waited at least five minutes between tonography of the first eye and tonography of the second eye. We consider, therefore, that any bias introduced by the earliest measurements would be very small.

TABLE 2

DISTRIBUTION OF INTRAOCULAR PRESSURE, C AND K FOR RIGHT AND LEFT EYES FEMALE SUBJECTS

O.D.						O.S.					
IOP		c		K		IOP		c		K	
x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)
12	1	0.10	1	1	1	12	1	0.10	1	1	2
14	2	0.15	3	2	2	14	2	0.11	1	2	3
15	1	0.16	2	3	8	15	2	0.15	8	3	14
16	4	0.17	1	4	11	16	2	0.16	1	4	8
17	1	0.18	1	5	10	17	4	0.18	1	5	11
18	10	0.20	5	6	11	18	6	0.19	2	6	11
20	5	0.21	1	7	2	19	3	0.20	6	7	3
21	2	0.22	1	8	4	20	11	0.22	1	8	2
22	5	0.23	2	9	3	21	2	0.23	3	9	1
23	11	0.24	1	11	2	22	5	0.24	1	11	1
24	1	0.25	2	16	1	23	8	0.25	2	12	1
25	7	0.26	8			24	1	0.26	2		
27	5	0.27	1			25	6	0.27	1		
		0.28	2			26	1	0.28	4		
		0.29	1			27	3	0.30	9		
		0.30	6					0.31	1		
		0.31	2					0.33	1		
		0.32	1					0.36	2		
		0.33	2					0.38	1		
		0.36	1					0.39	1		
		0.39	1					0.41	1		
		0.45	4					0.46	3		
		0.46	1					0.48	1		
		0.47	1					0.51	1		
		0.48	1					0.53	2		
		0.50	1								
		0.61	1								
		0.69	1								
Total	55		55		55		57		57		57
Aver.	21.0		0.29		5.45		20.3		0.27		4.77
s^2	14.4		0.013		6.70		19.9	s^2	0.011		4.68
s	3.79		0.115		2.59		4.46	s	0.105		2.16

IOP, c, and K between right and left eyes of our female subjects were not statistically significant.

Table 3 contains the IOP, c, and K values, the absolute frequencies, averages, s, and s^2 for the male subjects studied and thus again permits the comparison of variances for the male groups. The ratios of the variances compared with the F limit (1.51) showed the differences to be significant for c and K, but not for IOP. That is for male subjects there is a significant difference between the right and left eye for values of production and facility of outflow of aqueous humor, the values for the left being lower. Attributable to chance, however, is the difference between IOP of the right and left eyes of our male subjects. The same results were obtained when the data were analyzed with the t-test.

Discussion

Study of intraocular pressure in right and left eyes revealed no statistically significant difference; tonometry alone does not give sufficient insight into the intraocular-fluid dynamics to permit conclusions about a possible predilection of one or the other eye for glaucoma.

The clinically observed predilection of the left eye for glaucoma might become understandable by consideration of the production of aqueous humor, the facility of its outflow and the resistance to outflow, the reciprocal value of the facility. These data, obtained by tonography, showed significant differences

TABLE 3

DISTRIBUTION OF INTRAOCULAR PRESSURE, C AND K FOR RIGHT AND LEFT EYES
MALE SUBJECTS

O.D.						O.S.					
IOP		c		K		IOP		c		K	
x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)	x	f(x)
14	1	0.15	6	2	1	14	1	0.11	1	2	1
16	3	0.19	2	3	10	16	3	0.13	1	3	13
17	3	0.20	6	4	11	17	7	0.14	1	4	19
18	7	0.22	2	5	14	18	9	0.15	1	5	11
19	3	0.24	1	6	7	19	3	0.18	1	6	10
20	12	0.25	2	7	11	20	7	0.19	1	7	2
21	2	0.26	3	8	7	21	2	0.20	16	8	6
22	9	0.27	4	9	2	22	13	0.21	1	9	1
23	11	0.28	1	10	1	23	10	0.23	4	10	1
24	1	0.29	2	11	1	24	2	0.24	1		
25	8	0.30	11	12	2	25	4	0.25	1		
26	1	0.31	3			26	2	0.26	4		
27	5	0.32	1			27	1	0.27	1		
28	1	0.33	2					0.29	1		
		0.34	1					0.30	13		
		0.35	1					0.33	2		
		0.36	2					0.34	1		
		0.37	1					0.36	1		
		0.38	2					0.38	3		
		0.39	2					0.39	2		
		0.41	1					0.41	2		
		0.42	1					0.43	1		
		0.43	1					0.44	2		
		0.44	1					0.46	1		
		0.45	1					0.48	1		
		0.46	2								
		0.49	1								
		0.50	1								
		0.52	1								
		0.64	1								
		0.70	1								
Total	67		67		67		64		64		64
Aver.	21.5		0.31		5.73		20.7		0.27		4.89
s^2	10.4		0.012		4.99		8.75		0.0075		3.05
s	3.22		0.11		2.23		2.96		0.085		1.75

between the aqueous humor dynamics of the right and left eye.

The right eye has a greater facility of outflow, that is, a lower resistance, and a higher intraocular fluid production than the left eye. We do not know of any embryologic, local anatomic, or local physiologic data to explain these differences between the right and left eye; differences in intravascular pressure between the right and left innominate veins and the great neck veins may lead to a better understanding, as suggested in a previous discussion of the apparent predilection of the left eye for glaucoma.[2]

Considering the male and female subjects collectively, the differences between right and left eyes concerning resistance to aqueous outflow were significant; they were even more significant for the eyes of the male subjects alone. The values for the eyes of all female subjects, although showing the same trend, did not show significant differences. This discrepancy is difficult to understand; it would be worth while to investigate whether corresponding discrepancies might be found when glaucoma patients, grouped according to sex, are studied as to incidence and severity of glaucoma relative to their right and left eyes.

SUMMARY

Tonographic study of 122 right and 121

left normotensive eyes revealed no statistically significant difference in intraocular pressure; however, the left eyes showed a greater resistance to aqueous outflow than the right eyes; these differences were present in the eyes of both male and female subjects but were significant only in the male group. These findings may help to explain the eye pressure differences between normotensive right and left eyes, reported by previous investigators, and the clinically manifest predilection for glaucoma of left eyes.

5 West Fourth Street (2).

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Ophthalmic Miniature

They (the lashes) have been seen to whiten suddenly, like the hair, as a result of a vivid impression. Madame la baroness D. was 6-½ months pregnant when she heard one of her children fall and cry out. She climbed a flight of stairs, running; the intense emotion that she felt whitened in an instant the lashes of the lids of the right eye.

A. P. Demours: *Traite des Maladies des Yeux*, Paris, 1818. Vol. I, page 14.

MUSCLE SURGERY AND ORTHOPTICS

In the treatment of comitant nonaccommodative strabismus

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Before discussing the relative value of surgery and orthoptics in comitant strabismus, a satisfactory cure must be defined. One cannot say that strabismus is functionally cured unless: (1) No tropia is shown by the cover test, both for distance and near; (2) the patient is able to fuse Worth's four dots, both for distance and near; (3) the patient is able to fuse with a red glass before one eye, both for distance and near; (4) visual acuity is equal or nearly so in each eye; and (5) there is no incomitance. To be more thorough, you might add the requirements of bar reading, physiologic diplopia, fusion with amplitude, and a near-point of convergence of at least 100 mm.

Using these minimum standards, an attempt has been made to evaluate 382 cases of comitant esotropia and 101 cases of comitant exotropia, all of which were operated upon between June, 1945, and January, 1955. There were 22 other cases eliminated from this study because they did not return following surgery, or for other reasons. Since only those cases involving surgery were studied, this report does not include accommodative esotropia. It also does not include some cases of intermittent exotropia which were satisfactorily cured by refraction and orthoptics alone.

Not all of these cases were clear-cut. Age is a factor. A test is not always conclusive in the case of a child of, say, two or three years. In some cases it was felt that some degree of fusion was present postoperatively in children two or three years of age, because the cover test showed no more than a phoria and convergence was good, even though we were unable to utilize Worth's four dots or other tests to substantiate the diagnosis. For the purpose of this report, we considered such cases functionally cured.

The current trend among ophthalmologists in all parts of the world, but particularly in America, is toward early surgery. For my own part, I tend to operate at a much earlier age than I used to, actually performing surgery for nonaccommodative comitant strabismus as soon as a satisfactory diagnosis has been made, provided vision is equal in both eyes and the patient alternates freely. I have no minimum age limit below which I will not operate although I agree with Lyle that, because the binocular reflexes are undeveloped in the first year of life, there is little to be gained by surgery before the age of 15 months.

Table 1 shows the results of surgery in the 382 cases of comitant convergent strabismus. Some cases were treated orthoptically

TABLE 1

Nonaccommodative comitant esotropia

	Fusional Result		Cosmetic Result	
Age at Operation	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Group I 0–3 78 Cases	26	2	37	13
	35.9%		64.1%	
Group II 4–5 114 Cases	16	23	42	33
	34.2%		65.8%	
Group III 6–7 68 Cases	2	16	21	29
	26.5%		73.5%	
Group IV 8–12 62 Cases	2	8	24	28
	16.1%		83.9%	
Group V Over 12 60 Cases	6	3	44	7
	15%		85%	
Total 382 Cases	52	52	168	110
	27.2%		72.8%	

both before and after surgery, and many were treated by occlusion for amblyopia and anomalous retinal correspondence. Of all cases treated surgically, 27.2 percent were functionally cured. Cases complicated by a high vertical anomaly, anisometropia, intractable amblyopia, or other entities which render a functional result unlikely, if not impossible, are included in the total number so that a functional result in one fourth of the cases does not seem unsatisfactory. It can be seen that the percentage of successful results is higher in cases operated before the age of six years, and that the number of successful results diminishes in each older age group.

In Group I, birth to three years, functional results are obtained without benefit of orthoptic training and the only form of training ever used in these patients is occlusion in order to produce alternation. In Group II, more patients are amenable to orthoptic training, although this does not increase the percentage of functional cures. I am inclined to believe that the important factor in these two groups is the relatively young age at the time of surgery; orthoptics seem to be of supplementary importance.

Fusion is a phenomenon which requires time and practice for its development. Nearly everyone is born with the potential ability to fuse but, if an obstacle is present, fusion may not develop. When the obstacle is an insurmountable deviation, fusion may be made possible by surgery. But it must be done early. It must be done while there is still an opportunity for development to take place, and usually this is too early for orthoptics to be of much assistance. This is particularly true of cases with early onset.

A fusional result was obtained in only 20.4 percent of those cases in which the onset occurred before 18 months of age and in 30.9 percent of those cases the onset of which occurred after 18 months.

Orthoptic training is employed regularly, when co-operation of the patient is adequate and visual acuity is equal or nearly equal in the two eyes. In Group III, the number of patients who attained a functional cure without benefit of orthoptics is markedly diminished and in this group one must depend largely on orthoptic training to re-educate the fusional reflexes. There is as high a percentage of successful results in this group, as in the over-all series.

TABLE 2

COMITANT EXOTROPIA

	Fusional Result		Cosmetic Result	
Age at Operation	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Group I 0–3	11	0	3	0
14 Cases	78.6%		21.4%	
Group II 4–5	3	12	3	1
19 Cases	78.9%		21.1%	
Group III 6–7	3	12	8	0
21 Cases	66.6%		33.3%	
Group IV 8–12	1	17	2	2
22 Cases	81.8%		18.2%	
Group V Over 12	3	10	10	0
23 Cases	56.5%		43.5%	
Total	21	51	26	3
101 Cases	71.2%		28.8	

After the age of seven years (Groups IV and V), the number of successful results from surgery, either with or without orthoptics, is smaller.

Table 2 shows the results of surgery and orthoptics in comitant divergent strabismus. It can be seen that the percentage of successful results is approximately the same in all age groups. Here the need for early surgery is certainly not apparent. The reason is obvious. Most cases of divergent strabismus, particularly in children, are intermittent or periodic or both, and these patients exhibit fairly good fusional capacity. Some of these patients never require surgery, because the elimination of suppression and increase in

TABLE 3

COMITANT EXOTROPIA—CONSTANT

Age at Operation	Fusional Result		Cosmetic Result	
	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Group I 0–3 4 Cases	1	0	3	0
	25%		75%	
Group II 4–5 3 Cases	1	0	2	0
	33.3%		66.6%	
Group III 6–7 5 Cases	0	1	4	0
	20%		80%	
Group IV 8–12 6 Cases	1	5	0	0
	100%			
Group V Over 12 18 Cases	4	5	9	0
	50%		50%	
Total 36 Cases	18		18	
	50%		50%	

fusional amplitudes by orthoptic training enables them to keep their deviation latent.

In 36 of these cases, however, there was exotropia which was not intermittent but constant (table 3) and half attained a functional result. Here the successful results were largely in the older age groups and there is no reason to believe that early surgery is as important here as it is in convergent strabismus.

During the past six years I have been performing surgery symmetrically whenever possible in order to reduce the incidence of postoperative incomitance. The required amount of recession or resection is divided between the two eyes, usually at the same operation. My experience shows that nonsymmetric surgery is frequently followed by incomitance, usually in the field of action of a recessed muscle.

Table 4 illustrates the prism-cover measurements in a patient thus operated and is shown only as an example. Preoperatively, the prism-cover measurements were approximately the same in the primary position and in the six cardinal directions of gaze. After a recession-resection on the right eye, prism-cover measurements revealed a cosmetic cure in the primary position but there was still a moderate esotropia in dextroversion and a considerable exotropia in levoversion. It should be obvious that a functional cure is unattainable in such a case since the surgery has only replaced a comitant deviation with an incomitant one.

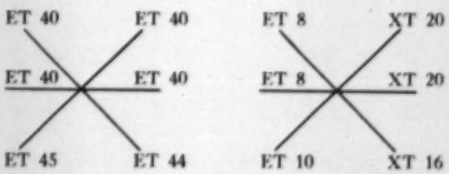
I perform symmetric surgery in all cases in which I feel that there is a chance for a functional result, unless the amount of operation required is so small that it cannot be divided between the two eyes. Nonsymmetric surgery is still done in cases in which a cosmetic cure is all that can be expected.

Table 5 demonstrates the value of symmetric surgery in helping to provide a functional cure in comitant convergent strabismus. Slightly more than one fourth of the 382 cases in the series obtained a functional cure. Symmetric surgery was performed in 147 cases, resulting in cure of nearly one half; whereas, when nonsymmetric surgery was employed, success was obtained in only 15 percent. This may be explained partly on the basis of case selection, for I tend to use symmetric surgery in cases in which I feel that there is a chance for success. But even

TABLE 4

INCOMITANCE FOLLOWING NONSYMMETRICAL SURGERY

D.B. age 8



Preoperative	Operation	Postoperative
sc ET 48 ET′ 50	Recession RMR 3 mm. Resection RLR 7 mm.	sc ET 2 XT′ 10

TABLE 5

NONACCOMMODATIVE COMITANT ESOTROPIA

Type of Surgery	Fusional Result		Cosmetic Result	
	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Symmetric	39	29	47	32
147 Cases	46.1%		53.9%	
Nonsymmetric	13	23	121	78
235 Cases	15.3%		84.7%	
Total	52	52	168	110
382 Cases	27.2%		72.8%	

when all cases in which there was no chance for cure are eliminated from the series, the percentage of successful results was higher when symmetric surgery was done.

The same thing is true of comitant divergent strabismus, as shown in Table 6. Symmetric surgery resulted in 85.7 per cent cures in 42 cases. This is 25 per cent better than the results obtained by nonsymmetric surgery. In both groups, surgery combined with orthoptic training resulted in a higher percentage of cures than was obtained by means of surgery alone. I think it is very significant that only three of all the cases treated orthoptically were functional failures; whereas, in 26 cases out of 47 treated by surgery alone, I failed to obtain a cure.

TABLE 6

COMITANT EXOTROPIA

Type of Surgery	Fusional Result		Cosmetic Result	
	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Symmetric	9	27	5	1
42 Cases	85.7%		14.3%	
Nonsymmetric	12	24	21	2
59 Cases	61%		39%	
Total	21	51	25	3
101 Cases	71.2%		28.8%	

In my opinion, there can be no doubt that surgery should be done symmetrically whenever possible, and particularly when there is a good chance for functional success. The incomitance which often follows nonsymmetric surgery is a definite obstacle to proper alignment, normal correspondence, and fusion. Nonsymmetric surgery should be limited to cases with no chance for cure, and to cases in which the surgery indicated is too small to be divided between the two eyes. There is no objection, however, to performing surgery on the two eyes in two stages, because incomitance from unilateral surgery may be overcome by performing a similar procedure on the other eye.

It is well known that the results of muscle surgery cannot be accurately predicted. But all muscle surgery should be graded. The idea, for instance, of doing all recessions indiscriminately to the equator is untenable. Technique in muscle surgery varies widely with different surgeons; so it is impossible for one to advise another how much recession or resection to do in any given case. It should be possible, however, for a surgeon to judge for himself approximately what results he will get from a given procedure, provided of course that he has standardized his technique and has had enough experience with it. I do not pretend to know, prior to an operation, how many millimeters of recession or resection will result in how many prism diopters of correction. I can approximate, however, because I always measure my surgery and I always use the same technique.

In determining how much surgery to employ great emphasis is placed on such factors as age of patient, age of onset, amount, intermittency, and variability of the squint measurements, status of retinal correspondence, presence of amblyopia, and the nearpoint of convergence. These are simply matters of experience.

Proper selection of cases is important in obtaining a satisfactory percentage of functional cures. In this regard the preoperative

status of the patient must be considered. The chances for cure are greatly enhanced if the vision is equal (or nearly so) in each eye, and if there is free alternation on the part of the patient. On the other hand, anomalous retinal correspondence, anisometropia, and the presence of a high vertical component (over four or five diopters) in the primary position lessen the chances for cure.

Since free alternation implies equal vision in both eyes, they may be considered together. Table 7 shows the results of surgical treatment when free alternation and equal vision are present preoperatively. It may be seen that 192 of the 382 cases (almost exactly half) were in this category. Functional cures were obtained in 41.1 percent of them. On the other hand, when alternation was not present preoperatively, success was only 13.1 percent. In cases in which there is some possibility that a functional cure may be the end-result, I make every effort to equalize the vision by occlusion; when vision is equal, if voluntary alternation does not occur, I use alternate occlusion until surgery.

As noted in Group I, the functional results are almost equally good whether or not orthoptic training is combined with surgery. This is certainly due to the fact that most patients in this group are also in the younger age group and frequently develop single binocular vision when the deviation is removed surgically. It is much more difficult to teach alternation to older patients, especially if the squint is of more than a few months' duration. In Group II, a functional cure is obtained more often when orthoptic training supplements the surgery. I have also found that consecutive divergence does not often result from surgery on alternators and this is an added incentive to encourage alternation preoperatively.

TABLE 7

NONACCOMMODATIVE COMITANT ESOTROPIA

Pre-Operative Status	Fusional Result		Cosmetic Result	
	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Alternating Freely and Equal Vision 192 Cases	41	38	70	43
	41.1%		58.9%	
Monocular Fixation Preference 190 Cases	11	14	98	67
	13.1%		86.9%	
Total 382 Cases	52	52	168	110
	27.2%		72.8%	

TABLE 8

COMITANT EXOTROPIA

Pre-Operative Status	Fusional Result		Cosmetic Result	
	Surgery Only	Surgery and Orthoptics	Surgery Only	Surgery and Orthoptics
Alternating Freely and Equal Vision 81 Cases	17	48	14	2
	80.2%		19.8%	
Monocular Fixation Preferemce 20 Cases	4	3	12	1
	35%		65%	
Total 101 Cases	21	51	26	3
	71.2%		28.8%	

Table 8 shows the results of treatment in 101 cases of comitant exotropia. A total of 80.2 percent of those alternating freely preoperatively were functionally cured (Group I), while only 35 percent of nonalternators (Group II) were functionally cured. Even more significant, of 54 cases in which orthoptic treatment supplemented surgery, only three failed of success; whereas, in 47 cases in which surgery alone was used about half failed. Does this not speak well for the value of orthoptic training?

Anomalous retinal correspondence, anisometropia, and the presence of a high vertical component in the primary position lessen the chances for a functional cure.

There is very little which may be done about anisometropia except to correct it with glasses, and to try to equalize vision when the

difference in the refractive error between the two eyes is not too great. This can sometimes be done. More often, however, surgery, by necessity, is cosmetic. Five cases of more than moderate anisometropia are found in the series of 382 patients with comitant convergent strabismus. None of them fused postoperatively. One case of only moderate anisometropia is found in 101 patients with comitant exotropia and this patient obtained a fusional result.

The presence of a vertical component is also a serious obstacle in the road to functional success. Operation to correct the vertical deviation in such cases invariably is indicated because no other form of treatment can hope to restore parallelism of the visual axes. No general rule can be laid down for surgery on vertically acting muscles, and the importance of a proper diagnosis cannot be overemphasized.

When an obvious weakness of a vertically acting muscle exists, I believe a shortening operation is the procedure of choice. More often no gross weakness is apparent, however, I then perform a weakening procedure on the overacting yoke muscle.

In the 382 cases under discussion, 74 showed a definite vertical anomaly. Surgical correction of the vertical component was attempted when there seemed a chance for a functional cure. Table 9 shows this was obtained in six cases or 8.1 percent. In each of these six cases surgery resulted in complete correction of the vertical error. This is so much lower a percentage than in the over-all series that there can be no doubt that the existence of a vertical anomaly renders the chance of cure very small and that, if cure is to result, the vertical error must be corrected.

TABLE 9

NONACCOMMODATIVE COMITANT ESOTROPIA

	Fusional Result	Cosmetic Result
Vertical Component Present 74 Cases	6 (8.1%)	68 (91.9%)
No Vertical Component Present 308 Cases	98 (31.8%)	210 (68.2%)
Total 382 Cases	104 (27.2%)	278 (72.8%)

Anomalous retinal correspondence was found in 93 of the 382 patients with nonaccommodative comitant esotropia, using the after-image test to confirm the diagnosis whenever testing on a major amblyoscope revealed an angle of anomaly. This incidence (24.3 percent) seems somewhat lower than that reported by others. Perhaps I have been fortunate in being confronted less frequently with this problem for I have been only moderately successful in dealing with it.

Table 10 reveals the influence exerted by anomalous correspondence on the successful fusional result: only 9.4 percent of my cases developing postoperative fusion, even with the aid of orthoptic training, as against the 32.4 percent of 289 cases which had normal correspondence when first seen.

The routine treatment of cases presenting this problem consists, first, in preventing binocularity by constant and full occlusion, either of the amblyopic eye in monocular squinters or of each eye in turn in alternators. To patients old enough for orthoptic training, preoperative office exercises are given, using standard techniques. If no improvement is noted after four or five visits, no further attempt at preoperative training is made. It is believed that proper surgical alignment of the eyes will result in binocular stimulation of the maculas as readily as any preoperative training. Normal retinal correspondence may not be an immediate result of surgery, however. Frequently several months will go by before normal correspondence can be demonstrated. In most cases, postoperative training is helpful. When surgery does not result in complete alignment of the visual axes, occlusion should be continued until further surgery is done.

It was possible to restore normal cor-

TABLE 10

RETINAL CORRESPONDENCE IN COMITANT ESOTROPIA

	Fusional Result			Cosmetic Result	
	Surgery Only	Surgery and Occlusion Only	Surgery and Occlusion and Orthoptic Training	Surgery Only	Surgery and Orthoptics (Preoperative and Post-operative)
Anomalous Retinal Correspondence 93 Cases	0	4	6	17	66
		9.4%		90.6%	
Normal Retinal Correspondence 289 Cases	52	42		151	44
	32.5%			67.5%	
Total 382 Cases	52	52		168	110
	27.2%			72.8%	

respondence in 34 of the 93 patients who exhibited anomalous correspondence when first examined (table 11). One half of these were successfully treated by preoperative occlusion and bifoveal stimulation, and showed normal correspondence at the time of operation. Six (35.2 percent) obtained a functional result.

TABLE 11

RESULTS OF TREATMENT OF ANOMALOUS RETINAL CORRESPONDENCE

		Fusional Result	Cosmetic Result
Normal Retinal Correspondence Following Pre-operative Orthoptic Training 17 Cases		6 (35.2%)	11 (64.8%)
Following Surgery without Orthoptic Training	Early 7 Cases	1	6
	Late 6 Cases	3	5
		(26.6%)	(73.4%)
Following Surgery and Orthoptic Training 2 Cases		0	2
Abnormal Retinal Correspondence Unchanged 59 Cases		0	59
Total 93 Cases		10 (9.4%)	83 (90.6%)

Fifteen cases did not respond to preoperative orthoptics but developed normal correspondence postoperatively without benefit of further training. In seven of these cases, the correspondence was found to have become normal immediately after surgery and in eight cases the correspondence did not become normal until several months had passed. Only four (26.6 percent) of these 15 were functionally cured. There is little reason to believe, therefore, that preoperative orthoptic training for anomalous correspondence increases the percentage of patients in whom normal correspondence is restored. It is significant, I think, that even when normal correspondence is restored, either by orthoptics or surgery, or both, the fusional results are disappointing. It is, nevertheless, apparent that unless normal correspondence is restored, failure is inevitable.

There is no reason to believe that failure to restore normal correspondence will result in failure to restore ocular alignment. The statement has frequently been made that patients with anomalous correspondence tend to revert to their preoperative angle of deviation. This is not so. Of 59 cases in which anomalous correspondence was not abolished either by orthoptic training, surgery, or both,

in only nine (15.2 percent) was the angle of deviation unchanged by surgery and all of these were small angle tropias. Fifteen cases (25.4 percent) showed a marked reduction of the angle of deviation and 33 cases (55.9 percent) were rendered cosmetically straight. Two cases (3.5 percent) showed a postoperative divergence. This would seem to prove that the presence of anomalous retinal correspondence is not a bar to cosmetic cure.

Eighteen years ago, when orthoptics was just beginning to enjoy its present phase of popularity, there was a widespread feeling that it could reduce or eliminate the necessity for muscle surgery in many cases. This was an excusable, but unfortunately erroneous, belief. It is now known that, with the exception of accommodative esotropia and a few instances of small-angle intermittent exotropia of the divergence-excess type, orthoptics alone will not overcome a deviation. Only surgery can do it.

Preoperative orthoptic training frequently can, however, provide an adequate sensory background so that, when the proper motor background is provided by surgery, normal binocular vision has a better chance to develop. Postoperative orthoptic training should aim at aiding this development.

Conclusions

Certain conclusions may be drawn. The percentage of functional cures is high when surgery is performed early.

In comitant convergent strabismus before the age of six years, surgery gets good functional results. After the age of six years, functional cures following surgery are attained in most cases only with the aid of orthoptic training and, the older the patient, the less chance of success whether orthoptic training is utilized or not.

Comitant divergent strabismus may be cured functionally at any age, and there seems to be no reason for urging early operation on the grounds of function alone. Other factors, such as psychologic trauma, increase in exotropia with time owing to an increasingly divergent position of the orbits and a lessening of accommodational tone, may justify early surgery in those cases which do not respond to orthoptics. Surgery should be done as soon as it is apparent that the exotropia is becoming constant.

When surgery is performed, the goal should always be proper alignment of the visual axes without incomitance and without impairment of convergence ability. For this reason surgery is best done symmetrically, and great care should be exercised in recessing the medial recti in the face of a poor convergence near-point.

In order to bring the eyes into alignment, the amount of surgery to be done should be planned carefully, and careful consideration given in advance to the age of the patient, the age of onset, and the amount, variability, and intermittency of the squint measurements.

In last analysis, success in the treatment of nonaccommodative comitant strabismus depends on adequate and complete co-operation between the ophthalmologist and the orthoptic technician, the former correcting the deviation and the latter providing the necessary sensory background on which fusion may be built.

Given an otherwise healthy, intelligent, and co-operative patient, failure to cure a squint satisfactorily is due either to the surgeon's failure to abolish surgically the deviation, horizontal or vertical, or to the failure of orthoptics to help the patient to overcome anomalous correspondence and amblyopia. In this, as in any task worth doing, there is no substitute for experience.

414 David Whitney Building (26).

NOTES, CASES, INSTRUMENTS

A DOUBLE-PROJECTION CAMPIMETER*

A. Hagedoorn, M.D., and
Ch. van den Bosch
Amsterdam, The Netherlands

The need of the ophthalmologist for an accurate and standardized registration of the visual fields led to the development of various methods and the construction of a number of apparatuses.

In Amsterdam most of the routine work was done on an old-fashioned campimeter, in preference to an instrument devised by Zeeman in 1925 or to a Maggiore perimeter. For an accurate tracing of the central part of the field, Bjerrum's method could be easily applied by placing the patient at the desired distance from the apparatus.

This simple campimeter is far from ideal: (1) Since the mode of presentation is a tangential one, the accuracy is low in the region outside 30 degrees; (2) though always freshly painted with diffusely reflecting black paint, the surface often reflected some degree of disturbing light; (3) the differences in illumination, plus the movements of the sticks carrying the objects, interfered with accuracy. However, these disadvantages did not prevent continued popularity of this campimeter in the hospital.

This most unscientific, unstandardized apparatus remained popular because of:

1. Its simplicity.

2. In drawing with chalk on the black campimeter, the examiner directly observes and controls the building up of the field of the patient. He may easily make corrections by washing away the chalk indications. He may also repeat an individual examination if the statement of the patient is evidently not correct or deserves repeated confirmation.

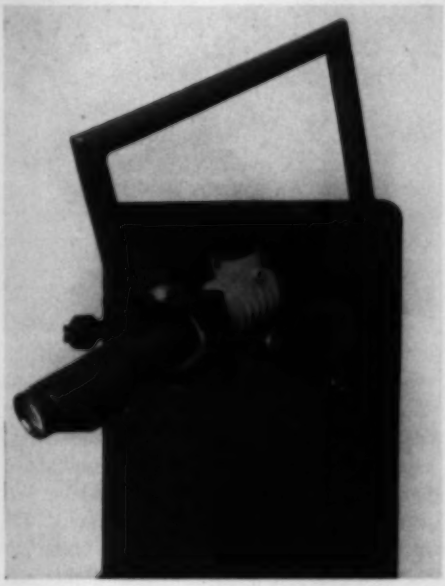


Fig. 1 (Hagedoorn and van den Bosch). Spotlight A.

3. The test objects may be presented less tangentially to the patient, so that the individual examiner may get satisfactory results. (Consequently the value and comparability of these fields are much influenced by the personality of the examiner.)

4. The Bjerrum method may be easily applied by placing the patient at the desired distance; also, the same registering advantages are available.

In glaucoma and other diseases in which an accurate follow-up of the field defects is highly desirable, even indispensable, the lack of standardization seemed most disturbing. In these cases the central fields are more important (30 degrees), so that special attention should be paid to Bjerrum's method.

In 1939, in a study of the scotomas in deficiency diseases, the use of "double-projection" campimetry was suggested (Hagedoorn). The patient was to be con-

* From the Ophthalmologic Clinic, University of Amsterdam. Director: Prof. A. Hagedoorn.

This study was aided by a grant from the Blaauw fund.

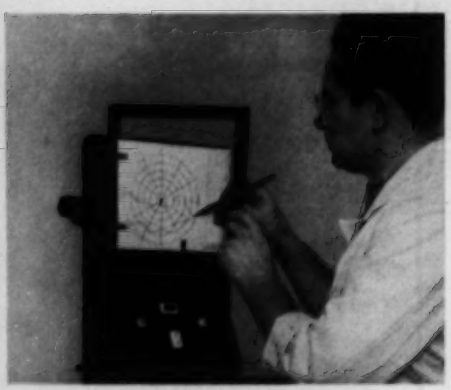


Fig. 2 (Hagedoorn and van den Bosch). Spotlight B.

fronted with a gray Bjerrum field reflecting a known amount of light under a constant illumination. On this surface would be projected light stimuli of known intensity. The spotlight should be connected with some mechanical device to another tiny spotlight, making exactly the same movements, projecting a delicate light-spot on the chart used for plotting the field. This registration would offer the same facilities which made the simple blackboard method so popular in spite of all its disadvantages.

Designing a mechanical device for a field larger than 30 degrees was attempted first but, after considerable difficulty, the endeavor was finally abandoned. No apparatus which is superior to the excellent perimeter of Goldmann can be suggested at present.

The instrument devised and constructed by Mr. van den Bosch was simple and of strong design, fit for daily use and routine work, fulfilling all the above-mentioned requirements.

It consists of a strong Ω shaped tube. At one end of the arm is a strong projection spotlight (fig. 1).* A flicker mechanism is attached. At the end of the other arm is a small spotlight. The Ω-shaped tube with its two spotlights is suspended in a cardanic joint which is attached to a vertical plate mounted on the table. The large spotlight projects a luminous spot on a gray Bjerrum screen at two meters' distance. The small spotlight projects a tiny spot of light on the chart at the posterior side of the vertical plate (fig. 2).

This apparatus provides, without complicated or expensive construction, the combination of an accurate Bjerrum screen method with the advantages of the simple blackboard campimeter in registering and

Fig. 3 (Hagedoorn and van den Bosch). Instrument in use.

* In this experimental apparatus a spotlight manufactured by Möller (nach Prof. Dr. Schober) was used. It enables projection of a series of white and colored spots.

observing the development of the field. Moreover, the intelligent patient cannot co-observe the gradual building-up of the drawing of the field and has no chance to anticipate when and where the light spot will appear or disappear.

A slight disadvantage is that the center of movement of the light-spot is at some distance over the eye (fig. 3) but this does not lead to significant inaccuracy. It has not seemed necessary to observe the eye of the patient (by a slightly concave mirror).

The use of a simple black spot at the fixation point was less satisfactory, since autokinetic sensations apparently develop, although the experiments were done in a well-lighted room.

Wilhelmina-Gasthuis.

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BLEPHAROPTOSIS*

A SIMPLE IMPROVED SURGICAL TECHNIQUE FOR ITS CORRECTION

ALBERT F. BORGES, M.D.
Havana, Cuba

Numerous surgical attempts to correct the eyelid condition known as blepharoptosis have failed completely or have resulted in mediocre success.

The earliest procedures contemplated elevation of the eyelid by shortening its vertical length by excising an oval section of skin, or a strip of the orbicularis oculi muscle, or the tarsus. All these attempts proved ineffectual for the tissues stretched and the deformity recurred. In 1880, Dransart sutured the ptosed lid to the frontalis muscle so that wrinkling of the brow and raising of the eyebrow would raise the lid. Other techniques, using the action of the frontalis muscle to raise the lid, followed. With these techniques, even if the frontalis is used successfully as an elevator, the patient is permanently condemned to corrugation of the brow and arching of the eyebrow in order to achieve lid elevation. Besides this, the frontalis muscle lifts the lid straight up and not up and backward as the levator normally does.

Correction of the ptosis by strengthening the levator was first suggested by Bowman. Eversbusch, in 1883, tucked and advanced the levator onto the front of the tarsus. This is only feasible in cases in which some levator action is present. Parinaud and Motais, in 1897, are credited with devising a method for using the lifting power of the superior rectus to raise the ptosed lid. These techniques have the disadvantages of sometimes producing annoying hypotropia and diplopia.

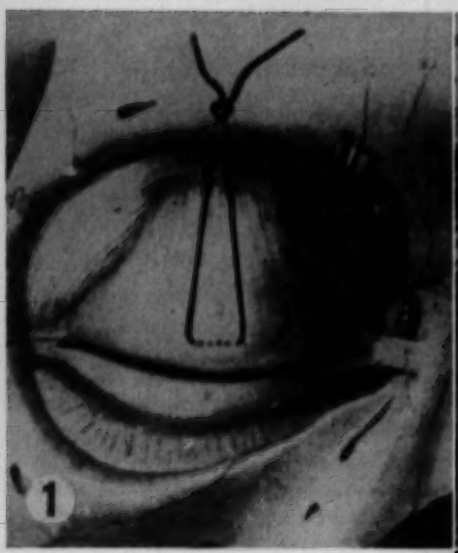
In 1950, at the ninth national assembly of Mexican surgeons, I met Dr. D. N. Matthews of London who explained to me the technique which he uses in the correction of cases of congenital ptosis in which no elevator muscle action is present. With fascia lata he sutures the tarsus to the supraorbital bony margin through four holes which he has previously drilled. If the frontalis muscle is not used to lift the eyelid, the patient will not have the appearance of perpetual surprise.

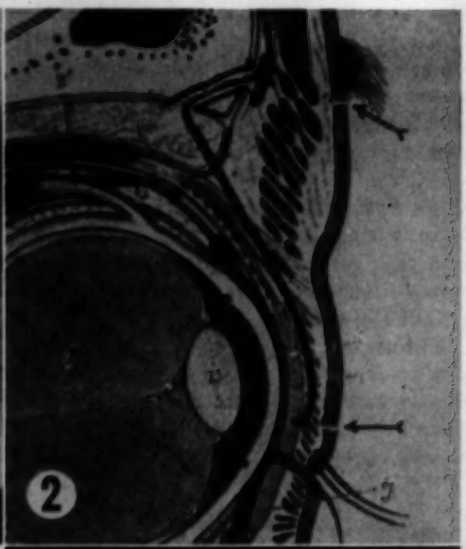
This technique, which I have not been able to find in any book or journal, is somewhat cumbersome since four holes have to be drilled in the bone; one hole may fall within the frontal sinus (or one may not be able to drill the hole if preoperative radiography shows large frontal sinuses); the supraorbital vessels and nerve may be injured; the technique requires operation on the leg to obtain the fascia lata strips; fascia lata once sutured may stretch, contract, necrose, or be pulled away from the tarsus.

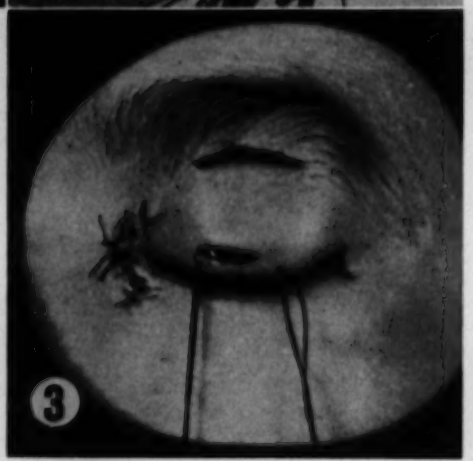
PRESENT TECHNIQUE

My operation is a tarsus-uplifting procedure by wire suture to the supraorbital margin.

* From the Liga contra la Ceguera Hospital.





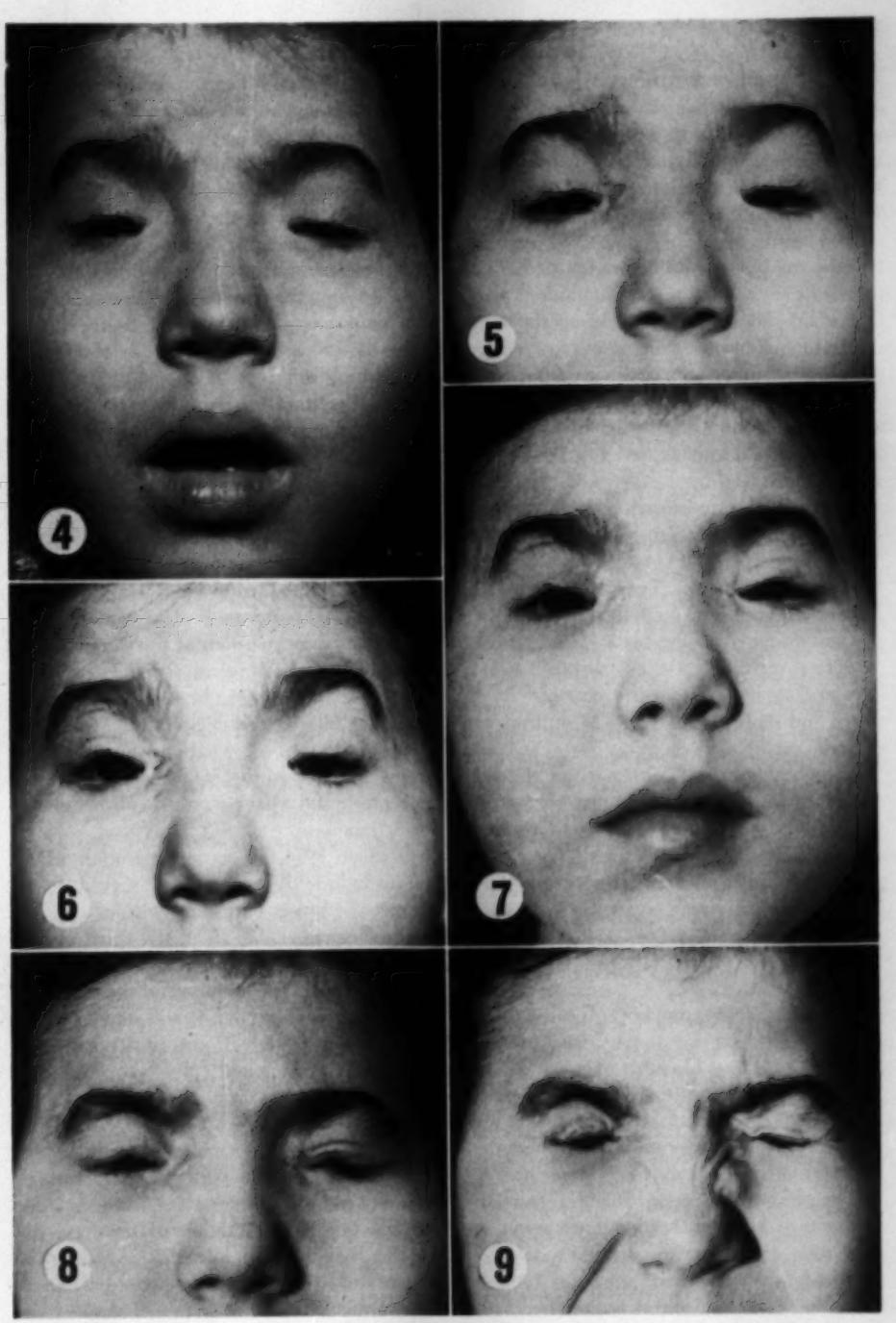


Figs. 1, 2, and 3 (Borges). (Fig. 1). Anterior view of right eyelids, showing wire suture before tying. (Fig. 2) Lateral view showing wire suture tied over tantalum; arrows indicate skin incisions. (Fig. 3) Anterior view of left eyelids showing skin wounds.

With the patient under general anesthesia, two traction sutures are placed through the upper lid margin in order to steady the upper eyelid without traumatizing the lid margin. A centrally placed 10-mm. incision is made through the skin, three mm. above the free margin of the lid and parallel with it. The lips of the skin wound are retracted upward and downward to expose the orbicularis muscle whose fibers are separated to allow access to the tarsus. Another horizontal skin incision, 15-mm. long, is made just under the center of the eyebrow, and continued down until the bone is reached.

The periosteum of a seven-mm. portion of the supraorbital margin is elevated and a small hole is drilled about three mm. above the edge and through the roof of the orbit.

With a wire suture (No. 35 stainless steel or tantalum), a firm bite is taken horizontally through the inferior margin of the tarsus. With a curved Steven's eye scissors a tun-



Figs. 4-9 (Borges). (Fig. 4) Preoperative. (Fig. 5) After right epicanthotomy and canthoplasty. (Fig. 6) After correcting the ptosis on the right side only. (Fig. 7) Postoperative, looking front. (Fig. 8) Postoperative, with eyes closed. (Fig. 9) Postoperative, with eyes in forced closure.

nel is made under the orbicularis oculi muscle connecting both incisions. Then the two ends of the wire suture are threaded through a large noncutting suture needle and passed, blunt end first, through the tunnel. Each wire in turn is then threaded through a small half-curved suture needle and passed through the hole in the bone from below upward. They are tied over a small piece of tantalum plate.

The lid should not be pulled up above the upper limbus in order not to overcorrect the ptosis. The sutures are tied with one knot at first to permit a study of the effect. When the lid margin has been adjusted to the proper height a second knot is tied and the sutures are cut short.

The wounds are closed with interrupted 4-0 atraumatic braided black-silk sutures. The conjunctival sac is filled with sterile boric-acid ointment. Two 4-0 black-silk sutures are passed through the lower lid margin and fastened to the brow with adhesive so as to cover the exposed cornea. Eye dressings are applied. These are changed in 48 hours and daily thereafter. The sutures are removed on the sixth day.

Lagophthalmos with exposure of the cornea especially during sleep must be avoided for the first three weeks by instillation of mineral oil and patching at night. The cornea gradually adjusts itself to exposure without ulceration or scarring.

Case report

M. O. A. (A.B. 3227), a girl, aged eight years, was referred by Dr. Morales to the plastic surgical service of the Liga Contra la Ceguera de Cuba (League Against Blindness) in September, 1954, for the correction of congenital abnormalities of the eyelids and adnexa. On examination it was found that she presented the syndrome described by O'Connor and McGregor: Bilateral congenital ptosis of eyelids, frontalis muscle in constant state of activity to permit vision, head tilted slightly backward, inversus type of epicanthal folds, palpebral fissure narrowed in the vertical and horizontal directions, eyebrows wide and abnormally high on the forehead, upper and lower eyelid skin deficiencies with upper-lid wrinkle absent, and nasal bridge poorly developed.

The mentality of the patient was at least average in spite of her stupid appearance.

Hereditary tendencies. Her father has the typical syndrome; her mother, two sister (13 and four years of age) and brother (five years of age) are without any lid deformities. Concerning this type of anomaly, Dr. R. N. Berke says that "cases of this sort present one of the most difficult problems in correction, and whatever functional and cosmetic improvement the surgeon can achieve must be considered an accomplishment."

Operation. On September 28, 1954, the first operation was done: Right epicanthotomy (Blair, Brown, and Hamm procedure) and von Ammon's right canthoplasty. Both sides were not done at the same time in order that the postoperative results could be compared. Also, it did not seem wise to have the child blindfolded bilaterally. Moreover, it was desired to see what part of the ptosed eyelid was due to the blepharophimosis and epicanthus and what part due to absent elevator action.

October, 1954, the second operation, using the technique just described, was done to correct the ptosis of the right side.

On November 12, 1954, the third operation was carried out. At one sitting the blepharophimosis, epicanthus, and ptosis of the left side were corrected. It was interesting to see how her feeling of inferiority vanished after the last operation.

Comment

Congenital ptosis should be operated on, if possible, before the patient reaches the age of three years. If one waits too long, amblyopia due to obliteration of the pupil by the lid may become intractable. Moreover, bad postural habits and cosmetic detriments like brow wrinkling and eyebrow lifting

should be corrected early. If the mouth is allowed to remain open for years, due to the postural habit of the patient, the mandible may not develop properly.

The advantages of this procedure are: (1) Brow wrinkling or eyebrow lifting is corrected; (2) it is simple and easily executed; (3) a normal lid fold is produced by pulling the lid upward and backward; (4) no diplopia or hypotropia is encountered; (5) there is no need for an additional operation, as in obtaining fascia lata; (6) the technique may be used in any type of ptosis; (7) equal width of the two palpebral fissures can be obtained by reoperation if needed.

Calle 36 No. 105, Miramar, Marianao.

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A SELF-RECORDING REMOTE-CONTROL TANGENT SCREEN*

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The remote-control tangent screen pictured here was designed after a careful analysis of the defects and deficiencies of the available instruments for charting central visual fields. It appears to combine and improve on the desirable features of the best of them, and yet presents very few disadvantages. It is so simply constructed as to be available to the practicing ophthalmologist at a cost comparable to that of the more conventional and less efficient types.

Basically this tangent screen device is made up of four components: the screen itself, a magnet, a pantograph, and a recording device. A specially shaped permanent magnet concealed behind the screen is used to manipulate the test objects. The magnet is held and moved by the four-foot arm of a pantograph, which is constructed of aluminum tubing. The pantograph acts as a proportionate lever arrangement for reducing and transferring a given angular measurement at the screen to a corresponding angular measurement on the smaller record sheet. The recording device consists of a pneumatic bulb which also serves as operating handle, connected by tubing to a small cylinder housing the plunger with its stylus point.

Principal features of the remote control tangent screen are:

1. The black fabric screen is four feet square, which gives a larger uniform background than the conventional type. It has no marks whatever except the fixation point, thus insuring that every response is completely independent of any reference point.

2. Test objects are of any desired size or color and are placed on the screen merely by touching them to the spot behind which the magnet may be felt. They glide easily over the screen without appreciable sound and remain wherever stopped.

3. The test objects are manipulated by means of an operating handle which may be located at either side of the screen. The pantograph ratio reduces the required hand movement to slightly less than one-half that

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Fig. 1 (Gunkel and Ryan). Self-recording, remote-control tangent screen.

of the test object, which greatly facilitates easy covering of the field.

4. Points are recorded instantly as found, merely by a light squeeze of the bulb which also serves as operating handle. No delay is required for recording, since the test object is moving very slowly in the critical area and the hand is already on the activating mechanism. The marking device consists of a small air-driven stylus which makes a slight indentation as it strikes the chart.

5. Any style of central field chart may be used, since the pantograph ratio can be set accordingly. The chart is clipped to a pad correctly located beneath the marking stylus.

6. Since the examiner uses only one hand to operate this device and records points without having to look, he is completely free to observe the patient, watch the test object, and watch the progress of the developing record.

7. If it is desired, a second marking bulb can be supplied with a tube extending it to the patient's hand. Some selected patients who are sufficiently alert and intelligent may be permitted to record their own points, especially after experience.

8. A shadow-free source of illumination is available in the form of a fluorescent circular light mounted to the chin-rest and through which the patient looks. It is probably the best assurance of seven foot-candle illumination at the screen. Illumination can be increased or decreased by moving a shutter lever. This permits giving correct illumination at either one or two meters, or applying sensitive tests under reduced illumination.

9. Wall space required for this instrument is not appreciably greater than that for the standard tangent screen. Ordinarily at least two feet must be allowed on either side of the conventional screen for free movement of the examiner. With this instrument, the examiner stands or sits in front of the pantograph, which requires approximately four feet, all on one side of the screen. The examiner does not need to cross in front of or walk around the patient at any time.

Examining procedure with this device is similar to that with the conventional tangent screen, but it is considerably simplified and shortened. Instructions to the patient are minimized, since there are no wands or hands to confuse him, and his initial astonishment at seeing the test object move as if by magic is sufficient to arrest and maintain his attention. This is a very important factor with any patient, and is especially so with children.

In routine examinations, we have found it convenient to explore first the field quadrant by quadrant with a 10-mm. white test object (larger if necessary) and locate the blindspot. It is carefully plotted by at least eight points found while moving slowly from the blind into the seeing area, and similarly for any scotoma. A sort of "leap-frog" pattern around the inside of the scotoma is found to be the most rapid and effective. The peripheral limits of the field to one millimeter white (or larger) are then traced by a similar movement, keeping the test object outside the field of vision most of the time. The blindspot is re-traced with one-mm. white and the entire field carefully explored for possible scotomatous areas. If a more exacting test for central or paracentral scotomas is desired, the patient is moved

back to two meters and the area thoroughly re-explored with the smallest test object visible. The illumination is suitably increased by re-setting the shutter lever to a calibrated position.

Color fields are plotted if desired. The isopters are completed by lines drawn between consecutive points. It is gratifying to find that with this instrument very little additional time is required to locate twice the usual number of points, which further authenticates any pathologic finding.

About 500 field examinations have been performed with this instrument, and it has been found without exception to reduce the time to less than one-half of that formerly required. Responses have been more prompt, definite, and consistent, and patients who were accustomed to the old method have been generous with unsolicited comments. The usual feeling is one of increased confidence in their own responses, decreased tensions, and general satisfaction at having completed the test so quickly and pleasantly.

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SIXTH-NERVE PALSY

With past-pointing to the opposite side

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Mrs. L. I., a 62-year-old white woman, was admitted to the graduate hospital on December 5, 1953, on the service of Dr. Edward Gosfield, because of double vision. An eye consultation showed a classic right sixth-nerve palsy with primary and secondary deviation. The patient had no diplopia on looking to the left but had diplopia in eyes front, which increased on right lateral gaze. The right eye could be rotated only a short distance past the midline. The patient also showed a grade-II hypertensive retinopathy. Corrected vision was 6/6 in each eye and visual fields were normal.

A neurologic examination was negative except for the right sixth-nerve palsy. A thorough medical survey showed a diabetic type glucose tolerance curve and hypertensive cardiovascular disease manifested by a blood pressure of 170/110 mm. Hg.

The unusual feature about this case was the fact that the patient insisted on having the normal left eye occluded. She was unable to get around if the paralytic right eye was occluded. Her preference for using the paralyzed right eye could not be explained by a visual defect in the normal left eye. The patient was then tested for absolute (egocentric) localization. It was found that, if her normal left eye was covered and she fixed with the paralyzed right eye, she did not past-point or past-walk at all. However, if the paralyzed right eye was covered and the normal left eye used for fixation, the patient past-pointed and past-walked to the left. This obviously was the reason she insisted on having her normal eye occluded.

There seems to be very little written regarding an explanation for past-pointing. Adler in his textbook, *Physiology of the Eye*, states "The direction of past-pointing is always in the direction of action of a paretic muscle." He then goes on to give two possible explanations for past-pointing. One is based on an excessive innervation to the paralytic muscle, giving the sensation that the object is farther to the right (in a

right sixth-nerve palsy) than it really is, and hence the patient past-points. The second explanation is based on the fact that an object in the right temporal field (in a case of right lateral rectus palsy) will not fall on the fovea of the right eye but on a nasal retinal element of that eye. Since the nasal retinal elements have local signs in the temporal field, the object is interpreted as being farther in the temporal field than it really is. Therefore, the subject past-points to that position in space which corresponds to the local sign of the part of the retina stimulated. Dr. Adler showed by certain experiments, using a large and small spotlight on a perimeter, that the angle of past-pointing is determined by the position of the image on the retina, and he concludes "It is not necessary, therefore, to account for past-pointing by assuming abnormal proprioception of the ocular muscles."

In the present case neither of these explanations would account for the past-pointing to the opposite side with the normal eye fixing. Therefore, Bárány and caloric tests were ordered to determine the integrity of the vestibular apparatus and median longitudinal fasciculus. The report came back "definitely no posterior fossa lesion."

The patient was put on a diet for her latent diabetes. Two months later she had completely recovered from the sixth-nerve palsy. She did not past-point or past-walk with either eye fixing while the other eye was occluded.

This case is of unusual interest for two reasons:

First, it was not possible to find any similar case reported in the literature.

Second, the usual reasons given for past-pointing certainly would not explain this bizarre case in which the past-pointing occurred to the opposite side when the normal eye was fixing.

2027 Spruce Street (3).

TRANSILLUMINATING ATTACHMENT FOR A PENLIGHT

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San Antonio, Texas

This transilluminating attachment is a modified eyedropper bulb. The larger end fits snugly over the bulb socket of the penlight as shown in Figure 1. The small end has an opening about five mm. in diameter. Through this opening, the beam of light emerges. The rubber tip makes sufficiently good contact with the bulbar conjunctiva so that little light escapes. Most of the light is directed into the eye through the sclera and adequate transillumination is obtained. Not enough heat is generated by the bulb during each contact period to be significant.

This cap may be removed from the light with ease and sterilized by cold solution or by boiling water. Usually a surface anesthetic is instilled prior to touching the globe. This is not entirely necessary, for most patients do not object when the bulbar conjunctiva is touched with this soft tip.

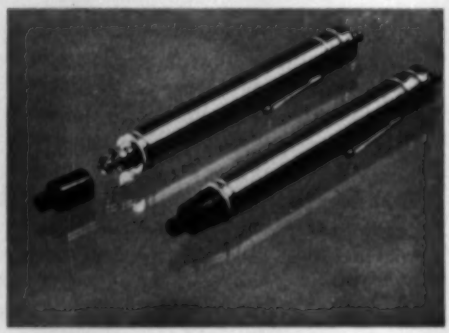

Fig. 1 (Nisbet). Transilluminating attachment for a penlight.

I have used this simple but adequate transilluminator for five years and have found it a convenient device, particularly for home or hospital examinations.

700 South McCullough.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

OPHTHALMOLOGICAL SOCIETY OF MADRID

May 28, 1954

OPTIC ATROPHY OF NEWBORN

DR. MARCELO CARRERAS read a paper on optic atrophy of the newborn following hemorrhages of the mother during the last months of pregnancy and presented the case of a child who had simple, bilateral, and incomplete optic atrophy. The only etiologic possibility was that the mother had suffered severe hemorrhages, of four days' duration, in the eighth month of pregnancy. The damage to the fetus seemed to warrant premature delivery. Analysis of the pathogenesis shows that all the characteristics of posthemorrhagic optic atrophy can be explained on the basis of anoxemia.

The latent period can be explained by the aggravation of the anemia in the days following the hemorrhage as a result of the normal destruction of the blood cells, without them being properly replaced by the exhausted bone marrow. The final picture of optic neuritis which at times precedes optic atrophy is due to a moderate papillary stasis because of hypoproteinemia. Because of asphyxia of the nerve this is accompanied by dimness of vision. The infrequency of optic atrophy after very severe hemorrhage is due to the fact that in most cases death follows, and the special lesions associated with optic atrophy do not have time to develop. Finally, it is a question of probabilities as to whether the atrophy will show itself before irreversible lesions are produced in the vital bulbar centers. This depends more or less, among other things, on the intensity and duration of the anoxemia.

One important difference between the fetus and the adult, in this respect, is that while, in the adult, the process embraces anemia and also hypoproteinemia, in the fetus there is a compensatory hyperglobulia and the protein content of the blood is normal. This is the reason why, in the young, the atrophy appears very early and without a previous misleading phase of optic neuritis. The whole condition develops as a simple atrophy, bilateral, incomplete, of early appearance and with a tendency to improve during growth of the child and development of the visual functions.

In cases of complete unilateral, optic atrophy, one must think of other etiologies. Optic atrophies where visual disturbances begin only 40 days after the last hemorrhage cannot be explained on the basis of anemia and anoxemia, excluding, of course, the possibility of hidden hemorrhage.

Discussion. DR. MARIN AMAT pointed out that the latent period which follows hemorrhages, before visual disturbances appear, is in perfect agreement with what experience teaches, namely that, when amblyopia or amaurosis follows immediately after hemorrhage, it is of extreme gravity; when disturbed vision appears somewhere between 12 hours and three days, the results are less serious; if amblyopia appears still later, say between three and 15 to 18 days, the results are again of increasing gravity.

The current concept that moderate and repeated hemorrhages have a worse influence on vision than a single profuse bleeding conforms with what we observe in practice, if we exclude the very severe hemorrhages which may lead to death. The latter, however, do not concern the ophthalmologist but the internist.

Posthemorrhagic visual disturbances are, fortunately, not very frequent. Still they are not rare. What is very rare is to see cases of complete loss of vision. I disagree with Dr. Carreras on this point. I know there are

cases of complete optic atrophy in which the amaurosis is complete.

In the cases of more or less marked amblyopia, the ophthalmoscopic appearance of the papilla is misleading. We often see papillas rather pale and almost atrophic looking associated with relatively godd vision; on the other hand, there are cases with marked loss of vision in which the optic papillas appear almost normal.

Joseph I. Pascal,
Translator.

MEMPHIS EYE, EAR, NOSE, AND THROAT SOCIETY

Pseudoglaucoma

Dr. H. Condron presented a 23-year-old white man, who was admitted to the Kennedy Veterans Hospital as a transfer from Birmingham, Alabama, on March 29, 1954. The patient's chief complaint was chronic drainage from the left ear; his transfer diagnosis was suspected chronic otitis media, left ear. His ear difficulty dated back to childhood when he had recurrent drainage from the left ear; on several occasions it had to be "lanced." One month following entry into the service in 1951, he again had left-ear drainage because of which he was given a medical discharge in late 1951. Since then he has had recurrent bouts of drainage from the left ear.

The past history revealed nothing abnormal except for vague gastrointestinal complaints, not associated with any acute pain, hemoptysis, or melena. The patient had no ocular complaint or history.

Physical examination: showed a well-developed, 23-year-old white man, in no acute distress. The blood pressure was 110/60 mm. Hg. The only positive finding was a slurring of the apical systolic sound. The liver was palpable two finger breaths below the costal margin; it was nontender, smooth in outline, and sharply edged.

Special eye examination revealed: Vision: R.E., 20/20; L.E., 20/20. Extraocular muscles were normal. Corneas, lids, and conjunctivas were normal. The pupils were round, equal, and reacted to light and accommodation. Tension by Schiøtz: R.E., 20 mm. Hg; L.E., 20 mm. Hg. The corneas and media were clear. The nerveheads showed a deep, glaucomatous-type excavation. The retinal vessels appeared normal. There were no retinal lesions. Visual fields showed no contraction; however, the blindspots could not be charted. The patient would not admit to blindspots with any size target.

Laboratory findings: Chest X-ray films, negative; CBC, within normal limits; urinalysis, negative; STS, negative.

Tension readings were taken a number of times and the highest recording was 20 mm. Hg, O.U. The patient's eyes were dilated with 10-percent neosynephrine and the tension was again taken and recorded at one- and two-hour intervals. At the end of one hour the tension was 17 mm. Hg, O.U.; at the end of the second hour the tension was unchanged. The patient has never had any ocular complaints, has never worn glasses, and states that he has never known anything to be wrong with his eyes. He denies any noticeable field loss and seems confused by all the interest shown in his eyes.

The problem in this case is whether a low-tension glaucoma or a pseudocoloboma of both optic nerves may be present. The absence of any field loss is against low-tension glaucoma. There appears to be normal nerve tissue about the entire circumference of the disc. If a coloboma is present, it probably is limited to the lamina cribrosa. The clinical picture is certainly that of glaucomatous cupping; however, with such a picture there should be some sort of field defect. Still there is none. Diagnosis is deferred.

Angiospastic retinopathy

Dr. H. G. Farish reported A. F., a 49-year-old Negress, who was presented to the society last year. At that time she showed a macular lesion in the right eye, which was thought to be a disciform degeneration. The other possibilities considered at that time

were melanoma because of questionable elevation in the region of the macula, chorioretinitis, and a metastatic tumor. Because of a nodular mass at the sternoclavicular junction, she was seen by the orthopedic service which reported that the lesion was not malignant. Since that time she has been seen at regular intervals with gradual apparent flattening and recession of the macular lesion.

In July, vision was 20/40, O.D., and the staff was of the opinion that this was definitely a case of angiospastic retinopathy. She was placed on nicotinic acid, 50 mg., three times daily. No local medication was given.

On August 30th, she returned for a routine check up, complaining of a "skim over the left eye." Despite the complaint, vision was: O.D., 20/25+; O.S., 20/25+. In the left eye, there was a generalized vitreous haze, much more dense on the nasal side. The details of the fundus could not be seen. The macular lesion in the right eye appeared somewhat flatter, with increased pigmentation.

On this date, she was admitted to the hospital for observation and diagnosis. She was observed for some time without change in the cloudiness in the left eye. As there was no improvement by bedrest foreign-protein injections, and atropinization, she was discharged on nicotinic acid.

She was not seen again until September 29th when she reported to the clinic with vision of 20/30+4, O.D.; 20/20, O.S. The vitreous haze had cleared to the extent that fundus details could be seen temporally. The nasal retina was still obscured by a deep vitreous haze. In the macula of the right eye, there was now a circumscribed area which appeared to be a serous infiltration under the retina. She was continued on nicotinic acid.

The next visit, one week later, revealed two such circumscribed areas lateral and inferior to the macula. They had a pinkish color. On this date, October 8th, the disc in the left eye could be seen for the first time. There was little loss of vision throughout these episodes.

On November 5th she was admitted to hospital for a course of typhoid-vaccine therapy. Three injections were given intravenously, with fever reactions up to 101.5°F. each time. The last dose was 30,000,000 organisms. Objectively, it was doubtful if the status of the left eye had changed. It seemed to be the logical conclusion that the vitreous haze was due to hemorrhage.

Since this discharge she has had no therapy, more because she became intolerant to nicotinic acid than an independent decision to cease treatment on our part. The fundus in the left eye can now be well visualized temporal to the disc. The nasal portion is still obscured by vitreous opacities and floaters, evidently posterior to the equator. The macula of the right eye is now quiescent but shows definite residual degeneration. Today her vision with correction is 20/15, O.U.

Retrolental fibroplasia

Dr. James E. Wilson reported cases of retrolental fibroplasia in identical twin boys, Stanley and Stephen P., aged six months, who were first seen January 26, 1954.

The mother has one normal boy, aged five years, and she has never had a miscarriage. During pregnancy with the twins she had never been ill in any way.

At seven and three-quarters months she went into labor spontaneously. Urine, blood work, and Kahn test did not indicate any disease. Labor was normal. She had scopolamine and Demarol followed by 10 minutes of C_3H_6 anesthesia during actual birth of the twins. All three stages of labor lasted a total of five hours. One child was born vertex and the other breech. Stanley, weighing four lb. and eight oz., was born at 10:25 P.M. on July 28, 1953, and Stephen, weighing three lb. and 15 oz., was born two minutes later.

Physical examination of each shortly after birth showed the heart to be normal, no anomalies were noted, but both had grunting respiration, poor aeration, and possibly atelectasis at the base of the lungs.

Orders for the two infants were identical: (1) Both were put into the same isolette and oxygen was used at a rate of four liters per

minute; (2) nothing by mouth for 24 hours then glucose water; (3) Synkamin (1.0 cc. hypodermically, daily); (4) caffeine sodium benzoate (four drops hypodermically when necessary for stimulation).

After one week Stephen was doing well and was removed from the isolette and put in an older type of incubator in which the oxygen concentration was not so high. After 21 days, they were both removed from oxygen without any tapering off in concentration.

Both babies were fed the same, receiving all the mother could supply augmented by evaporated milk and sugar.

On the 12th day Stephen developed an abscess of the buttocks at an injection site and was given penicillin (300,000 units daily for three days).

On the 25th hospital day Stanley developed diarrhea and was given paregoric (five drops twice daily for three days). They received no other medications.

At the time of their discharge on September 1, 1953, Stanley weighed five lb., two oz.; Stephen weighed four lb., 13 oz.

When the parents brought the twins to the office on January 26, 1954, they complained that neither of them appeared to see normally. The parents said that, when they tried to look at something the eyes moved slowly in searching movements. A grayish reflex had been noticed in one pupil of each child.

Examination showed that Stanley had searching and rolling movements but no nystagmus. Both pupils reacted but the left quicker. He followed a light with the right but did so only poorly with the left eye.

The right fundus showed the entire temporal retina to be detached and grayish and a band came over and slightly beyond the disc; however, the nasal retina looked quite normal.

The left fundus showed a bluish white band, similar to that seen in retinitis proliferans, coming from the periphery where it was narrow at the lower temporal position, spreading out as it went straight to the disc. At the papilla it was twice the size of the disc and completely obscured it. This band stopped at the disc and joined a similar band which came from the periphery originating from just above the horizontal on the temporal side. This band came across the position of the macula involving it.

Stephen's external eye examination was similar except that there was a very poor reaction of the left pupil.

The left fundus showed a completely grayish detached and elevated retina. The right fundus showed a band originating in the middle of the lower temporal quadrant. It broadened out to obscure the disc and partly involve the macula. It continued upward to the middle of the upper temporal periphery.

Re-examination on March 5, 1954, did not show any change from the original examination on January 26, 1954.

Racemose hemangioma of retina

Dr. Philip Meriwether Lewis and Dr. Douglas Hawkes (by invitation) presented a patient having both ocular and intracranial angiomatosis.

D. W. F., a white boy, aged 10 years, was first seen in 1947 at the age of three years. His mother stated he ran into things as if he did not see well and he tilted his head toward his right shoulder. Vision could not be determined but it was felt that he could see with both eyes. No limitation of motion could be detected. There was congestion of the conjunctival vessels and a slight fullness of the retinal vessels of the left eye. Retinoscopy showed two diopters of hyperopia of both eyes.

He was not seen again until October 30, 1948, when he was convalescing from meningococcic meningitis. At that time the blood vessels on the disc of the left eye were greatly dilated and angiomatosis was suspected. He was not seen again until three years later. Vision could then be determined. It was: 20/30, R.E., no light perception, L.E. The vessels of the left temporal region and upper lid were engorged. There was an enor-

mous dilatation of the vessels of the left disc and immediate surrounding retina. No angioma was seen.

In September, 1952, the left eye was congested externally and highly divergent. There was paralysis of both elevators and of the medial rectus. The retinal vessels were enormously dilated and tortuous and seemed to be much more numerous than normal. The engorgement was confined to the disc and the surrounding retina. This was the first time that proptosis was noticed. The periphery of the retina seemed to be normal and no angioma was present. The right eye was normal with vision of 20/30.

In November, 1954, vision of the right eye was 20/25 and the eye was still normal except for coarse nystagmus on looking to either side and paralysis of both elevators.

The left eye turned out about 20 degrees and slightly downward. There was complete paralysis of both elevators and almost complete of the medial rectus. There were four mm. of exophthalmos and a definite ptosis. The pupil reacted consensually but not directly. The veins of the upper lid were engorged and so were those of the temporal region. The coiled, medusalike vessels on the disc and surrounding it were approximately the same as they had been two years previously.

Paralytic convergent squint

Dr. B. Weisbaum reported the case of an 11-year-old Negro girl seen for the first time on July 22, 1953, with vision of: O.D., 20/25, J2; O.S., counting fingers. She showed a convergent squint, fixating only with the right eye. There was paralysis of the external rectus, O.S., indicated by inability to abduct the left eye past the midline. A paresis of the external rectus, O.D., was evidenced by weakness in external rotation. There was overaction of the internal rectus, O.S., with contractions. Measurements, using the perimeter, were on three occasions 25 degrees esotropia for near and 25 degrees esotropia for distance. Cycloplegic refraction on July 28, 1953, revealed emmetropia, O.U. The fundus examination was normal.

A diagnosis of convergent squint, due to paralysis of left external rectus and overaction of left internal rectus with contracture, was made. Consultation was obtained and a Hummelsheim procedure was decided upon.

On August 22, 1953, a five-mm. recession of the internal rectus and a seven mm. resection of external rectus plus a Hummelsheim tendon transplant was performed and both eyes were patched.

Twenty-four hours later the dressings were changed and the patient was discharged with a request to be in the clinic in 24 hours. Dressings were changed every other day for four times.

On September 2, 1953 (10 days after operation), there was good external rotation of left eye; slight divergence was noted. On September 16th (three weeks postoperative) examination revealed 50 degrees' external rotation of the left eye.

Diamox in acute glaucoma

Dr. Alice R. Deutsch reported the case of Mr. J. C., aged 76 years, who gave the history of having had recurrent severe eye inflammation all of his life and stated that he never saw well. He also had many rounds of sinus infection and bronchitis. He was allergic to many drugs and had severe reactions after the use of penicillin and the broad-spectrum antibiotics.

About four years ago his vision began to fail, especially in his right eye. A cataract operation was performed in 1952 and was complicated by intolerance to every kind of mydriatic. A glaucoma operation had to be performed several months later. Nevertheless the tension remained high, but could be controlled with 0.1-percent DFP once a day at bed time.

The left eye showed dense macula corneae, a normal anterior chamber, many posterior synechias, and a partial pupillary membrane. The pupil dilated incompletely and irregularly on 10-percent neosynephrine. A poste-

rior cortical cataract made fundus inspection difficult. Vision equalled 6/200. The intraocular pressure was never higher than 18 mm. Hg.

On April 10, 1954, in the evening he inadvertently put one drop of DFP in his left eye. Severe headache started about 15 minutes later. The headache continued all night, associated with nausea. However, he did not attribute this to his eye until the next morning when he noticed that he could not see. When examined a few hours later the ciliary body of the left eye was injected and the cornea edematous. The pupil was pinpoint and the anterior chamber shallow but there was apparently no typical iris bombé. The intraocular pressure was 80 mm. Hg. He was admitted to the hospital.

Besides the local use of 10-percent neosynephrine and cyclogyl (one percent), 250 mg. of Diamox were given to him and repeated after six hours, after which time the cornea was clearer and the tension 40 mm. Hg. The third dose of Diamox was given after eight hours after which time the tension dropped to 21 mm. Hg in spite of the fact that the pupil was still pinpoint. Diamox was continued every 12 hours for two doses and again after 24 hours until 1.5 gm. was given. Neosynephrine was continued.

It was not until after the third day that the pupil showed some dilatation. The intraocular pressure varied from 18 to 21 mm. Hg. Epinephrine-bitartrate ointment was used three times a day for one week and then discontinued. When the patient was last seen on April 15th, the pupil was of normal size and the pupillary membrane seemed to be denser; the intraocular pressure was normal and the vision, 6/200. Diamox seemed to be a definite help in the handling of this case.

Subarachnoid hemorrhage with subhyaloid hemorrhage

Dr. Richard L. DeSaussure presented the case of C. K., a 26-year-old medical student, who was admitted to the Baptist Memorial Hospital on April 1, 1954. He had been in good health until that day when he suddenly developed a left frontal headache without history of trauma. He went to the John Gaston Hospital emergency room because of this headache and was given Cafergot without relief. Soon after the Cafergot, the headache and the pain over the left eye became more severe. He soon noticed some difficulty with his speech, had some dizziness, and vomited. He was brought to the Baptist Memorial Hospital where he was admitted about 11:50 P.M.

At the time of the first examination, shortly after admission, his pupils were equal and reacted to light. There was a hemorrhage in the left optic fundus. There was some mental confusion, probably due to his mild aphasia. The cranial nerves were otherwise intact. There were no reflex, sensory, or motor changes. There was no stiffness of his neck.

The possibility of a subarachnoid hemorrhage was considered but a lumbar puncture was not done at the time of his admission. The following morning X-ray films of his skull were obtained and thought to be within the limits of normal. He was examined by an ophthalmologist who also thought spontaneous subarachnoid hemorrhage was a possibility. Subsequent to this a lumbar puncture revealed bloody spinal fluid under increased pressure.

By April 8th, he had improved clinically and a lumbar puncture revealed that the spinal fluid was only faintly xanthochromic without gross blood. We felt that bilateral carotid arteriograms should be done in an attempt to locate the suspected aneurysm; carotid arteriograms, to our surprise, were negative for aneurysm. We thought that the middle cerebral complex on the left was slightly elevated and the anterior cerebral artery was pushed slightly to the right. These findings, coupled with the fact that this student was not making the clinical progress we

had hoped for, made us suspect an intracerebral hematoma.

On April 13th, a ventriculogram demonstrated a shift of the ventricular system to the right. At operation, an intracerebral hematoma in the left temporal lobe was disclosed. It involved almost the entire left temporal lobe. The hematoma was evacuated and the edges of the brain adjacent to the hematoma were biopsied but there was no evidence of tumor in the biopsy specimens. We did not find the bleeding point; there was no evidence of an aneurysm, hemangioma, or tumor.

Postoperatively, this student did quite well except that the subtemporal decompression became tense and papilledema increased. It was our feeling that the intracerebral swelling was probably the result of operative trauma and not the result of further bleeding, although this was considered as a possibility. By April 25th, the subtemporal decompression had become soft and he was discharged from the hospital. At the time of his discharge he had some aphasia and, in particular, had difficulty understanding written words.

He was re-examined on April 30, 1954, at which time his decompression had become much softer, the papilledema was subsiding, and the vision of the left eye was improved. This is the eye in which the hemorrhage had occurred. He was re-examined on May 14th and showed further improvement.

This student falls within the group (described by Margolis, Odom, Woodhall, and Bloor in 1951) of individuals with intracerebral hematomas due to small angiomatous malformations. These occurred in young individuals with no history of predisposing factors. Their headaches occurred suddenly; generally, the patient became unconscious at a later date. Bleeding occurred in the white matter and, usually, the bleeding point could not be demonstrated. In a few cases minute angiomatous malformations were discovered. These authors felt that, in the other cases, the angiomas had been destroyed by the hematomas.

Subhyaloid hemorrhages have been reported in association with subarachnoid hemorrhage. However, it seems that they are usually associated with intracerebral hematomas. In a recent review, Golden, Odom, and Woodhall found that of 321 cases of subarachnoid hemorrhage only 15 had associated subhyaloid hemorrhages. In 51 cases of intracerebral hematoma without subarachnoid hemorrhage, seven had subhyaloid hemorrhage; however, in 13 cases of subarachnoid and subdural hemorrhage, six had subhyaloid hemorrhages. This gives a percentage of five percent for the pure subarachnoid hemorrhages, 14 percent for the intracerebral hematomas alone, and 42 percent for the subarachnoid plus subdural hematomas.

The mechanism by which the preretinal or subhyaloid hemorrhage is produced is still debated but the consensus seems to be that it is due to occlusion of the venous channels and is not a direct extension of the hemorrhage into the subhyaloid space. This is usually caused by sudden increase in intracranial pressure. This case serves to illustrate: (1) When a subhyaloid hemorrhage is noted in the presence of subarachnoid hemorrhage, a space-occupying lesion should be suspected and searched for; (2) the lack of nuchal rigidity does not exclude subarachnoid hemorrhage.

Daniel F. Fisher,
Recorder for the Eye Section.

AMERICAN JOURNAL OF OPHTHALMOLOGY

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MOORFIELDS

On March 25, 1805, the first public hospital devoted to diseases of the eye opened its doors in a very small building in Charterhouse Square, London. During the 150 years since, the institution has continued uninterruptedly, though with occasional changes of name and location and, among many unique distinctions, it is still the largest eye hospital in the world. The infirmary originated indirectly from the scourge of trachoma that afflicted the troops in the Napoleonic wars. The ophthalmic surgeon, John Cunningham Saunders, moved by the "terrible suffering of our troops from ophthalmia in the expedition to Egypt" founded the London Dispensary for the Re-

lief of the Poor Afflicted with Eye and Ear Diseases. Two years later its accommodations had to be restricted to eye patients only; and, in 1808, the name was changed to the London Infirmary for Curing Diseases of the Eye.

Saunders was a skillful eye surgeon and popularized in England the use of extract of belladonna in ocular therapy and to facilitate cataract extraction. He died of coronary thrombosis at the age of 37 years. His book, *Treatise on Some Practical Points Relating to Diseases of the Eye*, was published posthumously, but went through two editions, nevertheless.

In 1821, the hospital moved, again changing its name to become the London Ophthalmic Infirmary at Broker Row and Bloomfield Street in Moorfields. The current title, the Royal London Ophthalmic Hospital, dates from 1837. Though the hospital moved from Moorfields in 1899 to its present location at City Road and Peerless Street in the densely populated east end of London, the familiar appellation, Moorfields, remained unchanged.

Moorfields was followed by the establishment of similar hospitals throughout the country—in Exeter (1808), Bristol (1810), Manchester (1814), Birmingham (1823), and Glasgow (1824); and also in London—the Royal Westminster Ophthalmic Hospital (1816), the Central London Ophthalmic Hospital (1843), the Western Ophthalmic Hospital (1856), and the Royal Eye Hospital (1857).

In the century preceding the advent of Moorfields, the practice of ophthalmology in Great Britain was tarnished by quackery and plagiarism, plumbing the nadir in the notorious career of that prince of charlatans, Chevalier John Taylor. But as Sorsby sagely comments: "From Moorfields emanated a new conception of the place of ophthalmology in medical practice; when the need for orthodox practitioners with knowledge of eye disease was satisfied, quackery as a force vanished without a struggle."

British ophthalmology rapidly attained a status of commanding influence. Benjamin Travers, elected surgeon to Moorfields in 1810, published in 1820 the first extensive textbook on the eye in the English language. Moorfields began courses of instruction in 1814, and, in 1824, William Lawrence gave his famous lectures. Students came to Moorfields from every part of the world. Among them were Edward Delafield and John Kearney Rogers, the founders of the New York Eye and Ear Infirmary (1820) and Edward Reynolds, who studied under Lawrence and established with John Jeffries the beginning of the Massachusetts Eye and Ear Infirmary (1824). Similar American institutions followed in fairly rapid succession. The Wills Eye Hospital was opened in 1834, the New York Ophthalmic Hospital in 1852, the Illinois Eye and Ear Infirmary in 1858, the Knapp Memorial Eye Hospital in 1868, and the Manhattan Eye and Ear Hospital in 1869. By 1917, America had 58 hospitals and infirmaries specializing in the treatment of the eye.

The first British eye journal, the *Royal London Ophthalmic Hospital Reports*, was established by the staff of Moorfields in 1857, with Streetfield as editor. Its 20 volumes contain classic contributions by Bowman, Critchett, Lawrence, Hutchinson, Dalyrimple, Tyrell, Nettleship, Doyne, Coats, Gunn, Collins—and ever so many more. In time came *The Ophthalmic Review* (1881) and *The Ophthalmoscope* (1904). The three publications continued independently till 1917 and then merged into the present *British Journal of Ophthalmology*.

Moorfields not only stimulated the organization of eye infirmaries but its spirit influenced greatly the development of vigorous departments of ophthalmology in the medical schools which at the opportune time were ready to profit fully from the most recent scientific advances. Progress now demanded that the eye infirmaries exchange their autonomy for a university affiliation to the eventual advantage of clinical ophthalmology.

To further ophthalmic knowledge the university required clinical material and the clinic needed university co-operation. The assimilation finally resulted in a new pattern of systematized ophthalmic research, the ophthalmic institute, of which America has notable examples in the Wilmer Institute, Oscar Johnson Institute, Howe Laboratory, Institute of Ophthalmology of Columbia University, Kresge Eye Institute, and the Proctor Foundation for Research in Ophthalmology.

In 1947, there was founded in London, under the aegis of Sir Stewart Duke-Elder, the Institute of Ophthalmology "grafted onto Moorfields" with scientists employed full time in the basic-science fields and with ophthalmologists engaged part time in various clinical research projects. At its inception the institute recognized the need for an exhaustive index of all publications of eye interest, with the articles briefly abstracted for orientation. This specialized journal, suitably entitled *Ophthalmic Literature*, is published quarterly and is now in its eighth volume. Besides presenting ophthalmic references more completely than our *Quarterly Cumulative Index Medicus*, it covers too the nonmedical literature that has an ophthalmic bearing in journals of optometry, optics, physiology, and biochemistry. The articles listed annually have ranged from 3,761 to 7,004. Authoritative reviews on subjects of current interest also appear periodically, that leading the first volume of 1947 being on "Penicillin in ophthalmology" by Duke-Elder. Paraphrasing Terence, nothing affecting ophthalmology is foreign to this project—and it deserves wider recognition and usage by all English-speaking ophthalmologists.

James E. Lebensohn.

ABUSE OF ANTIBIOTICS*

In October, 1954, 172 speakers contributed to the Second Annual Symposium on Antibiotics.[1] In opening the discussion, Dr. Henry Welch not unreasonably said that it would take too much time to list the infectious diseases now partly or completely controlled by chemotherapy; instead he remarked that few of his large audience would not have some friend or relative who had been made well, or even been saved from death, through the use of antibiotic drugs. There was much to justify President Eisenhower's message to the symposium in which he described the meeting as an occasion for honoring all who through their work on antibiotics had made profound changes in the practice of medicine. Those honored would rightly include, not only medical and scientific investigators, but also the drug firms whose energy and enterprise made possible the necessary research and development on a vast scale.

With all this we are already familiar. But, owing largely to our own folly, the picture has a less favorable aspect. von Oettingen,[2] reviewing the untoward effects of the indiscriminate use of antibiotics, noted the possibility of such well-authenticated complications as glossitis and stomatitis; nausea, vomiting, and diarrhea; anal pruritis; vestibular and auditory disturbances; aplastic anemia; and allergic reactions of many kinds, including fatal anaphylactoid reactions, serum-sickness, and skin rashes. Admittedly most of these reactions are relatively uncommon in proportion to the widespread use of antibiotics, and most are temporary; but enough of them may produce serious damage and even fatal results to justify an earnest plea for caution against uncritical use of antibiotics. Apart from the danger to the patient such indiscriminate use must accelerate the emergence of resistant strains of bacteria among species which produce such forms. This has been said many times in these columns and elsewhere; indeed, it has been emphasized so often that its rehearsal may fall on deaf ears. It may have been some such thought that led Hussar[3] to propose a more active measure—a crusade for

* Reprinted by permission from *The Lancet*, May 21, 1955, pages 1059 and 1060.

the rational use of antibiotics. In his own analysis of fatal antibiotic reactions he showed that about half of the patients had died from unnecessary medication. He estimated that about 25 percent of patients in the medical wards of general hospitals would probably benefit from antibiotics. This figure was very close to that observed in three hospitals where strict indications had been set up for the administration of antibiotics. But in three other hospitals the proportions of general medical patients treated with antibiotics were 32 percent, 38 percent, and 41 percent; and in Hussar's view these higher figures reflect a too liberal use of antibiotics. He proposed: (1) a press release from the symposium condemning the irrational use of antibiotics; (2) systematic education of students and doctors on how to use antibiotics; (3) education to persuade the lay public that antibiotics are not invariably required; and (4) organization of a National Registry of Fatal Antibiotic Reactions to reveal the true incidence of such accidents.

What errors of judgment and practice have given rise to these sobering pronouncements? Three seem to deserve prominence. First, there is a belief that antibiotics are nontoxic and will do no harm even if they do no good. It is easy to see how this view arose. Penicillin, our first antibiotic, had a much greater margin between effective and toxic dose than any previous antibacterial drug, and untoward reactions were virtually unknown in the early days when it was administered in doses of the order of 15,000 units every four hours. Only when very much larger doses came to be used—at first for special cases but later almost as a matter of routine—and when sensitized patients came for second courses of treatment did it become clear that the drug was not altogether harmless. Later antibiotics are in general more toxic than penicillin and so allow less latitude in dosage. The second defect in our thinking touches this very point. Many doctors are guided by the popular but fallacious generalization that if a little does good a lot will do better. Many considerations doubtless combined to foster the use of big doses: they were required for bacterial endocarditis; they were bactericidal; they would stop the emergence of resistant strains; they would make for less frequent administration; and they would penetrate to the deepest parts of hidden lesions. Such considerations neglect two essential points: that many antibiotics have a relatively narrow zone of optimal concentration,[4] and that the doses recommended by manufacturers are the outcome of extensive pharmacologic and clinical studies. As Mennie[5] has rightly declared, clinical investigators should aim at determining the smallest amount that is effective therapeutically. One may smile at the plea for chairs of antibiotic medicine voiced by more than one speaker at the symposium, but the surest way to encourage such projects is to give antibiotics so heedlessly as to create the impression that yet another specialty is required.

The third wrong idea—inside as well as outside hospitals—is that since antibiotics are so dramatically effective against grave illnesses they will be at least equally useful for the treatment of minor disabilities. But many conditions with an infective component—for example, some skin diseases and chronic disorders of the cardiorespiratory systems—cannot be regarded as wholly or even mainly caused by infective agents. On the whole, antibiotics are disappointing in the treatment of such states, and the most probable outcome of their use is sensitization of the patient, who disseminates resistant staphylococci. For much the same reasons the so-called prophylactic use of antibiotics is very often unwarranted. It will be a bad thing if it comes to be regarded as a token of eccentricity or of over-confidence to do a deliberate surgical operation without "antibiotic cover." Court and his colleagues[6] emphasize the crucial fact that the more frequently the staphylococci in a particular community are exposed to a particular antibiotic, the more likely they are to become resistant to it. They

reversed their earlier policy of treating with penicillin all staphylococcal infections in the newborn, and have had no cause to regret their decision: no serious infection, such as pneumonia or osteitis, developed in any of the 633 babies with a superficial infection who were treated on conservative lines which precluded the use of antibiotics in the absence of some good clinical indication, such as evidence of a systemic infection. They have kept erythromycin in reserve for the patient whose life may depend on it. Dr. Forfar[7] and his colleagues use antiobiotics somewhat more liberally but no less rationally. How many others who prescribe antibiotics would care to defend their practice?

1. Antibiotics Annual 1954-1955: Proceedings of the Second Annual Symposium on Antibiotics. Edited by Henry Welch, Ph.D., and Felix Marti-Ibanez, M.D. New York, Medical Encyclopedia, Inc., 1955.
2. von Oettingen, W. F.: Ibid., p. 361.
3. Hussar, A. E.: Ibid., p. 379.
4. Gunnison, J. B., Kunischige, E., and Jawetz, E.: Ibid., p. 190.
5. Mennie, A. T.: Brit. M. J., April 16, 1955, p. 973.
6. Court, S. D. M., Green, C. A., Hutchison, J. G. P., and Neligan, G. A.: Lancet, May 7, 1955, p. 969.
7. Forfar: Lancet, May 21, 1955, p. 1071.

TRACHOMA

Meeting of the Second Expert Committee on Trachoma of the World Health Organization

In the week of September 7th-14th, the Second World Health Organization Expert Committee on Trachoma met in Geneva under the chairmanship of Dr. Roger Nataf of Tunis and with Dr. Mario Giaquinto of the World Health Organization's Section of Endemo-epidemic Diseases as secretary. Dr. Phillips Thygeson was elected vice chairman and Dr. Ida Mann, reporter. In addition to these officers, the committee was composed of Prof. G. B. Bietti of Parma, Italy; Sir Stewart Duke-Elder of London; Prof. Yasushi Nakamura of Tokyo; and Dr. B. Tabone of Malta. Present as consultants were Dr. G. Sicault, Director of Public Health, Morocco, and Dr. R. M. Taylor, head of the Department of Virology of the U. S. Naval Medical Research Unit No. 3, Cairo, Egypt. Observers for the World Health Organization were Dr. W. M. Bonne, director of the Division of Communicable Diseases, Dr. F. Maxwell Lyons of the Regional Office for Europe, and Dr. M. Freyche of the Section of Epidemiological Information and Morbidity Statistics. In preparation for the meeting a large number of papers had been submitted by various members of the Expert Panel on Trachoma and consultants for the attention of the committee.

The agenda of the meeting included consideration of the following aspects of the trachoma problem: (1) The present status of laboratory research in trachoma. (2) The etiology and differential diagnosis of non-trachomatous follicular conjunctivitis, with particular reference to the role of the new APC group of viruses. (3) Regional differences in the epidemiology and clinical aspects of trachoma and associated infections of the conjunctiva. (4) Recent advances in the treatment of trachoma with special reference to methods suitable for mass treatment campaigns. (5) The criteria of cure of trachoma. (6) The planning of antitrachoma projects and their integration in general public health services. (7) The appraisal of control projects. (8) International co-ordination of research on trachoma.

The week's deliberations resulted in a thorough airing of the present status of our knowledge of trachoma and of the lines of investigation being currently pursued; in an improved method of classifying the disease; in a plan for co-ordinated research and for the establishment of a center for the collection and distribution of virus material, sera, microscopic preparations, and so forth; and in new recommendations for mass treatment

of trachoma and the associated purulent ophthalmias.

A report was prepared by the committee for submission to the Council of the World Health Organization and for eventual publication, and plans for the preparation of a series of monographs concerned with various aspects of the disease were elaborated.

Phillips Thygeson.

CORRESPONDENCE

Straightening the record

Editor,
American Journal of Ophthalmology:

Some time ago I wrote you a letter which you were kind enough to publish in the October, 1955, issue of The Journal.

The whole point of the letter was that the word distichiasis (spelled without an R) was being constantly misspelled in the literature. I pointed out that distichiasis (without an R) was confused with trichiasis and that there was *no such word* as districhiasis (with an R). I even dredged up all the Greek roots to prove it.

Of course, the whole thing was something of a spoof and took a mild poke at a distinguished contemporary of The Journal which had recently mangled the poor distichiasis (spelled without an R). So what happened? The first time you used the word distichiasis (spelled correctly without an R) you made it come out distRichiasis (third line of the letter on page 590). Now the letter is not only pointless; it is a ludicrous shambles. The poke aimed at your distinguished contemporary landed smack in The Journal's own eye!

And oh yes! In my original letter there was a postscript which you omitted. It read: "P.S. In the interests of justice I should add that, given the slightest excuse, I could probably dredge up something similar in the esteemed A.J.O." Prophetic—wasn't it?

Ah, me! I'm afraid that distichiasis (spelled correctly without an R) hasn't got a chance.

(P.S. My name was misspelled too.)

(Signed) Sidney A. Fox,
New York, New York.

Surgical correction of cicatricial entropion and trichiasis

Editor
American Journal of Ophthalmology:

In The Journal for April, 1955, page 555, Dr. A. Diab and Dr. C. Matta, Beyrouth, describe Professor Webster's operation for correction of entropion and trichiasis due to trachoma. Since in Beyrouth more than 30 years ago I saw Dr. Webster perform his operation many times, and I myself have done it in the Syrian desert, I take the liberty to add a few words to the two authors' description.

An essential point in the procedure is to cause the lips of the wound in the lids to gape. If one places the graft from the lip directly on the wound and replaces the eyelid, one may find the graft pushed out by elastic tension in the lid which causes the lips of the wound to close firmly. One can cut the tarsus but I have seen Professor Webster make a little cut at both ends of the distal lip of the wound (the margin). This relaxes the tension and causes no disfiguration.

Grafts for both eyes (each two-mm. wide) can be taken from the same part of the lip. Since, in taking the graft from the lip, the lip is stretched, it may be difficult to judge the correct size of the graft. A guide that may be used is that the wound in the lid will measure a little less than half of the lip.

As pointed out by Dr. Diab and Dr. Matta, it is important to make the graft as thin as possible. To remove its subepithelial tissue and trim its borders, one spreads it out on the tip of the left fore-finger. On placing the graft on the wound, one will recognize the

epithelial (outer) surface by its shine. Before inserting the graft, Professor Webster used to remove the clamp and stop possible bleeding with a gauze compress.

Due to the smallness of the lower tarsus, Professor Webster performed his operation only on the upper lid. To correct entropion of the lower lid, he removed a fold of skin.

There is no doubt that this operation is one of the best for trachomatous entropion and trichiasis. It can be performed at any time in the course of the trachomatous process, although of course it works best when the disease has become stationary. Furthermore, it can be repeated "infinitely" (Professor Webster) if necessary.

I use this opportunity to express my gratitude to Professor Webster—unfortunately too late for him to receive it. He was a skilled clinician and surgeon. He was a gifted teacher. And he was a very fine human being.

(Signed) Henrik Møller,
Svendborg, Denmark.

BOOK REVIEWS

GLAUCOMA: A SYMPOSIUM. Organized by the Council for International Organizations of Medical Sciences (under the joint auspices of UNESCO and WHO). Edited by Sir Stewart Duke-Elder, England. Oxford, England, Blackwell; Springfield, Illinois, Charles C Thomas, 1955. 350 pages, bibliography, index. Price: $7.50.

In September, 1954, just prior to the Montreal, Canada, meeting of the XVII International Congress of Ophthalmology, 20 research workers and ophthalmologists from various parts of the world convened at Ste. Marguerite, Quebec, near Montreal, to hold a symposium on primary glaucoma under the chairmanship of Sir Stewart Duke-Elder. The members were Ashton and Langham of England; Bárány of Sweden; François and Weekers of Belgium; Sourdille and Hartmann of France; Leydhecker of West Germany; Malbran of Argentina; Elliott and Hodgson (secretary) of Canada; Goldmann of Switzerland; and Berens, Friedenwald, Grant, Kinsey, Kronfeld, Scheie, and Vail of the United States.

For three busy and fruitful days, amid peaceful and undisturbed surroundings, the many problems pertaining to primary glaucoma were presented in formal papers by well-known workers in this field and were discussed, both formally and informally, by all the members of the symposium. These papers and discussions have been carefully gathered together and edited by Duke-Elder. The information this volume contains might be said to represent the last word—as of now—on the subject of primary glaucoma and bears most careful study.

The symposium was divided up into the following parts:

Part I: Anatomy, physiology, and pathology of the vascular circulation in glaucoma; Part II: The dynamics of the intraocular fluid; Part III: The resistance to the outflow of the aqueous humor; Part IV: Gonioscopy; Part V: Provocative tests; Part VI: Clinical aspects; Part VII: General discussion and conclusions (by Jonas S. Friedenwald and Duke-Elder).

The members of the symposium agreed that there are two distinct types of primary glaucoma and suggested that they be designated officially and for the time being as (a) closed-angle glaucoma and (b) simple glaucoma.

The scientific papers are most carefully prepared and illustrated, and the discussion and conclusions contain much of value for further investigation in order to clear up the many unknown factors of these baffling diseases.

Derrick Vail.

OPTOMOTOR REFLEXES AND NYSTAGMUS. By G. B. J. Keiner, M.D., and C. O. Roelofs, M.D. The Hague, Martinus Nijhoff, 1955. 224 pages, bibliography. Price: 18 guilders.

Roelofs has devoted his attention to ocular nystagmus for 30 years and this monograph is his 12th and most definitive contribution. His associate, Dr. Keiner, published in 1951

a notable book on *New Viewpoints on the Origin of Squint*, but lamentably passed away in 1954 before the publication of this volume. The authors consider that the optomotor reflexes, monocular and conjugated, have evolved from postural reflexes. "Movements of contours over the retina become a conditioned reflex which is grafted onto and calibrated by the proprioceptive reflex and, like the latter, tends to maintain the original position of the eyes in the orbit." The conjugated optomotor reflexes are in turn grafted onto and calibrated by the vestibular reflexes. The gaze tonus is also maintained by subcortical nonoptical stimuli—vestibular and musculo-sensory. Since a pendular nystagmus is usually present in both daylight and darkness, the optomotor reflexes apparently influence the nonoptical gaze tonus. Pendular nystagmus is associated with insufficient development of both monocular and conjugated optomotor reflexes, but the latter is predominantly the most involved.

The extent to which the optical fixation tonus is disturbed can be satisfactorily judged by the degree of terminal-position nystagmus, the reaction to optokinetic stimulation with monocular and binocular vision and the weak fusion amplitude. In this respect the detailed analyses of 55 patients with various types of ocular nystagmus is most illuminating.

Optomotor stimuli form the basis of optical localization and hence of visual acuity. Poor visual acuity, alternating hyperphoria, strabismus, or abnormal correspondence may develop as a consequence of disturbed monocular optomotor reflexes. Asymmetric behavior of the eyes in binocular gaze on turning to the right and left indicates asymmetric development of the optomotor reflexes. In latent nystagmus there is a fixation tonus from each eye in the dirction of the other eye. Hence the eyes are still when both are open. The primary developmental disturbance in the optical fixation paths which causes this jerking nystagmus is probably in the area striata and its immediate neighborhood.

James E. Lebensohn.

HEBREW MEDICAL JOURNAL, 1955, Volume 1. Edited by M. Einhorn, M.D., New York.

This semiannual journal, now in its 28th year of continuous publication, features especially sundry historic aspects of medicine. Dr. A. Levinson of Chicago emphasizes the beneficial influence of Maimonides in influencing popular medical conceptions. Maimonides condemned amulets and superstitious remedies. Although he was unaware of the harmful bacteria that water may contain, Maimonides did know that boiling water made it safe for drinking; and because of this the Jews of the Middle Ages escaped the devastating epidemics then current.

James E. Lebensohn.

PHARMACODYNAMIC POTENTIALIZATION IN OPHTHALMOLOGY. By Joaquin Barraquer Moner, M.D., Barcelona, Barraquer Institute, 1955. 293 pages, 59 illustrations and an 11-page bibliography. (It is written in Spanish, but includes French and English translations.) Price: Not listed.

This monograph deals with the use of small doses of several drugs, such as those that block the sympathetic and parasympathetic nerves, together with hypnotics, curare, and other drugs that are given intravenously to produce local and general analgesia and akinesia.

By this method the author reports that deep sedation with muscular relaxation is obtained. The reflexes are not all abolished and the patient is conscious. The blood pressure is lowered, metabolism is reduced; and there is complete postoperative amnesia. A state of hibernation is produced.

Complications, such as vitreous loss and hemorrhage, in a series of cataract extractions were greatly reduced when using this method as compared with a similar series of extractions in which local anesthesia and akinesia were used. The method is one that deserves careful consideration.

Walter S. Atkinson.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

1

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Ashton, N., and Cook, C. **Studies on developing retinal vessels. I. Influence of retinal detachment.** Brit. J. Ophth. **39**: 449-456, Aug., 1955.

In the adult human retina, the choroidal circulation is apparently capable of nourishing the outer aspects of the retina to the inner nuclear layer area; the retinal capillaries extend no deeper than the outer limits of this inner nuclear layer. Artificially created retinal detachment in the adult cat reveals no effect, but in the kitten a profound effect is noted on the developing retinal vessels. This is manifested in the following manner: 1. the retinal vessels extend deeply into all layers and eventually penetrate the entire thickness of the retina to form a capillary plexus on its outer surface, and 2. the vessels may proliferate inward and form glomerular tufts in the vitreous. A great similarity is noted between the intravitreal proliferations found here and those seen in Stage I retrolental fibroplasia. This finding may play a role in explaining the retrolental fibroplasia seen in those cases in which supplemental oxygen was not given. (7 figures, 10 references)

Lawrence L. Garner.

Ashton, N., and Cook, C. **Studies on developing retinal vessels. II. Influence of retinal detachment on oxygen vaso-obliteration.** Brit. J. Ophth. **39**:457-462. Aug., 1955.

Further experiments with kittens show that retinal detachment prevents the vaso-obliterative effects of oxygen despite the continuous maintenance of high concentrations of oxygen. This would indicate that effective concentrations of oxygen are unable to reach the detached retina. Survival in air after detachment and exposure to oxgyen does induce vascular proliferative changes as were noted in part I of this article. These changes cannot be distinguished from those found in detachment alone. The latter makes for difficulty in evaluation since the vasoproliferative effects can be produced by oxygen, detachment alone, and vaso-obliteration associated with detachment. (6 figures, 2 references)

Lawrence L. Garner.

Pedler, C., and Ashton, N. **Sex of nuclei in ocular tissues.** Brit. J. Ophth. **39**:362-367, June, 1955.

A study of the morphology in the sex chromatin in cell nuclei of ocular tissues is made for the first time. The authors note that the sex difference in nuclear morphology is as prevalent in the eye as elsewhere and is best seen in the epithelial cells of the cornea and ciliary body and in the ganglion cells of the retina. (7 figures, 18 references)

Lawrence L. Garner.

Rossi, Antonio. **Alterations of normal vitreous which causes errors of interpretation.** Rassegna ital. d'ottal. **24**:57-65, Jan.-Feb., 1955.

Rossi is convinced, after careful studies, that by simple observation with the phase contrast microscope it is not possible to recognize a fibrous structure in the normal vitreous. The latter, as a hydrogel, possesses an actual organization resulting from protein micelle. When fibrinous formations are seen, they are evidently the product of alterations of the colloidal state. At the present stage of experimentation and knowledge it is impossible to be positive of the changes seen and described. (6 figures, 6 references)

Eugene M. Blake.

Warwick, Roger. **The so-called nucleus of convergence.** Brain **78**:92-114, March, 1955.

This long and detailed paper attacks the concept of a median nucleus of convergence (Perlia's nucleus). Serial sections were studied of the mid-brains of 100 monkeys, two chimpanzees, three humans, and several fetuses. Only about one-fourth showed median nuclei, and in only one-tenth were they well defined. It was also demonstrated that in those cases showing a recognizable central nucleus, the innervation from these cells was to the superior rectus and inferior oblique, and not to the medial recti. The literature is reviewed to demonstrate that the solidarity of the median nucleus concept is a literary perpetuation with little factual basis. (17 figures, 39 references)

Harry Horwich.

2

GENERAL PATHOLOGY, BACTERIOLOGY, IMMUNOLOGY

O'Day, Kevin. **Eleven cases of pseudoglioma.** Tr. Ophth. Soc. Australia **14**:70-76, 1954.

Descriptions are given of microscopic sections of eleven eyes with pseudoglioma. None of them could be attributed to maldevelopment of the eye but in all there was evidence of inflammatory origin. (10 figures, 6 references)

Ronald Lowe.

Unger, H., and Caroli, G. **Expulsive hemorrhage and weather.** Klin. Monatsbl. f. Augenh. **127**:64-67, 1955.

Twelve cases could be studied. There was no correlation with the weather before, during or after the bleeding. (3 tables, 5 references)

Frederick C. Blodi.

3

VEGETATIVE PHYSIOLOGY, BIOCHEMISTRY, PHARMACOLOGY, TOXICOLOGY

Appelmans, M., and Michiels, J. **Studies on the aqueous of rabbits after application of diamox.** Bull. Soc. belge d'opht. **108**:521-527, Nov., 1954.

This study is another endeavor to explain the tension-reducing affect of diamox. 125 to 375 mg. of diamox were inserted by tube into the pharynx of rabbits. The anterior chambers were punctured four hours after ingestion of the drug. The protein content of the aqueous of 24 eyes was measured. The

amount of aqueous was determined in eight eyes. Six animals served as controls. The anterior chamber of eyes in the animals fed diamox reformed to normal depth during 30 minutes exactly like the control animals but showed a definite increase in protein content which was independent of the amount of diamox taken and undoubtedly associated with an upset in the ionic balance and increased permeability of the blood-aqueous barrier. (2 figures, 11 references) Alice R. Deutsch.

Boros, B., and Takács, I. **Pharmacologic examinations of isolated iris, especially of nervous influences in experimental iritis.** Szemészet **2**:63-69, 1955.

The authors examined, on the isolated iris of cats, the change of the effect of some mediators and other substances after precipitation of tissue calcium. After pretreatment with oxalates the usual relaxing action of cocain and adrenalin becomes converted, the circular muscle fibers of the iris contract. The biphasic histamin effect turns to monophasic after the precipitation of tissue calcium. Having examined these phenomenon after sympathetic denervation, the authors observed that the reversion of adrenalin action does not take place after the elimination of the sympathetic stimuli. The effect of histamine and acetylcholin has not been influenced by sympathectomy. The experiments point to the role of the calcium ion and the sympathetic nervous system in the interpretation of the change of the effect of certain pharmacologic compounds. The data obtained with experimental iritis serve as a contribution to the molecular pathology of inflammation, and are an index to the significance of the quantitative changes in the calcium ion concentration. Gyula Lugossy.

Cascio, G., and Ponte, F. **The permeability of the crystalline lens after experimental retinopathy.** Rassegna ital. d'ottal. **24**:33-43, Jan.-Feb., 1955.

Studies were made of the permeability of the lens capsule after experimentally induced retinal degeneration from sodium iodide and section of the optic nerve. An increase in permeability was observed in some eyes so treated, showing greater osmotic activity. The action of an elective chemical substance suggests a nonspecific agent, capable of identification in the vitreous. Such degenerative changes have been shown by others to produce a profound metabolic change in the lens. (1 table, 22 references)

Eugene M. Blake.

Fornaro, Luigi. **Effect of somatotrophic hormones upon the healing of corneal wounds.** Rassegna ital. d'ottal. **24**:49-56, Jan.-Feb., 1955.

Two groups of rabbits were subjected to corneal injury, one by removal of a disc of corneal tissue with a trephine and the other by a through and through incision. The somatotrophic hormone (STH) was injected intramuscularly in all animals. The hormone influenced favorably the healing of epithelium and the formation of cicatricial tissue. The mechanism of action of the STH is discussed and its effect compared with other hormones. Unlike ACTH, cortisone, progesterone and insulin, there is no inhibiting effect upon the healing of corneal wounds. (4 figures, 20 references)

Eugene M. Blake.

François, J., and Rabaey, M. **The proteins of the corneal epithelium.** Bull. Soc. belge d'opht. **108**:641-652, Nov., 1954.

The corneal epithelium is very adequate for the study of tissue proteins because it is easy to isolate, because it is fairly homogeneous and contains cells which, morphologically, can be differentiated only by their shape and because it does not contain additional tissues. The

methods for the study of corneal proteins by electrophoresis are described. The beef cornea contains at least four soluble protein fractions. One of these fractions, namely fraction II, predominates considerably. No fraction contains lipoproteins. Fraction III presented a P.A.S. reaction, making the presence of muco-, gluco- or glycogen-protein combinations possible. (15 figures, 11 references)

Alice R. Deutsch.

François, J., Rabaey, M., Wieme, R., and Evens, L. **Electrophoretic study of the influence of the pH on the lens proteins.** Bull. Soc. belge d'opht. **108**:652-659, Nov., 1954.

Electrophoresis depends on the electric charges of the proteins, especially their OH and NH_2 groups. The electrophoretic results on protein extracts of the lens remains unchanged with a pH of 4 to 8.6. Fractions I and II are definitely methylated and become insoluble when the pH dropped lower than 3.5. Fraction III resisted acidification, remained unchanged, and should be considered more stable. (4 figures, 2 tables, 9 references)

Alice R. Deutsch.

Keup, W., and Steiger, R. **Amino acid elements of normal human aqueous fluid protein.** Brit. J. Ophth. **39**:503-506, Aug., 1955.

An attempt is made to determine the free and protein-bound amino acids in the aqueous humor by more reliable methods than have been used in the past. The composition of these amino acids is reported and compared with calculated serum protein and lens protein. The difficulties in this determination remain the same as in past studies, since the amounts of protein are very small while a relatively large concentration of inorganic ions remains in proportion to that of the amino acids. (1 figure, 1 table and 14 references) Lawrence L. Garner.

Lowe, Ronald F. **The formulation of eye drops for the Australian and New Zealand Pharmaceutical Formulary.** Tr. Ophth. Soc. Australia **14**:84-91, 1924.

A description is given of the ophthalmic vehicles used in the formulation of eye drops for the eighth edition of the Australian and New Zealand Pharmaceutical Formulary. Formulae have been considered under the following headings: active medicament, preservative, buffers, isotonicity, corneal penetration and viscosity. The following antiseptics have been used: cetrimide 1 in 20,000 solution, methyl-hydroxybenzoate and propyl-hydroxybenzoate, chlorbutol and thiomersal. Isotonic phosphate buffers are used for salts of some alkaloids. A heat treatment, by immersion of the eye drops in a boiling water bath for 30 minutes, is given for preparation of practically aseptic extemporaneously prepared eye drops. Special formulae are discussed for fluorescein, eserine, penicillin and tetracycline antibiotics. (9 references)

Ronald Lowe.

Maurice, D. M. **Influence on corneal permeability of bathing with solutions of differing reaction and tonicity.** Brit. J. Ophth. **39**:463-473, Aug., 1955.

The author attempts to ascertain the range of test solutions which will permeate the adult rabbit cornea and yet not cause changes in its permeability. Test solutions of NaCl ranging in concentration from 0.18 to 10 percent and in pH from 2 to 11 were employed. When solutions hypotonic to normal saline were employed, a rise in epithelial permeability was noted. This reached a maximum of about ten times normal at about 0.4 percent NaCl. Hypertonic solutions did not alter the epithelial permeability in either direction, although the endothelial permeability was increased. Using solutions buffered from pH 4 to 10 did not affect the epithelium, but when solutions out-

side of this range were used, the corneal permeability increased. (2 figures, 13 references) Lawrence L. Garner.

Parry, H. B., Tansley, K., and Thomson, L. C. **Electroretinogram during development of hereditary retinal degeneration in the dog.** Brit. J. Ophth. **39**:349-352, June, 1955.

In normal puppies retinograms cannot be recorded until about 21 days after birth. At this time the retinogram appears normal except for a small b-wave which becomes full-sized at about 50 days of age. An attempt is made here to ascertain whether an electroretinogram can be obtained from puppies with hereditary retinal degeneration. Electroretinograms were taken 22 days after birth of a litter of puppies, both parents of which were known to be affected, so that all offspring were homozygous for the retinal condition. Repeated tracings were made until 48 days after birth and pathologic sections were made at intervals. The findings indicate that the ability to produce an electroretinogram is more closely connected with the presence of differentiated rod outer limbs than with the actual number of degenerating visual cell nuclei. The findings corroborate previous work done with mice and rabbits, indicating that an electroretinogram cannot be obtained from an eye until the rod outer limbs and visual purple have appeared. (2 figures, 1 table, 10 references) Lawrence L. Garner.

Siliato, Francesco. **Pharmacological studies and clinical use of diethylaminoaceto-2-6-xililide in ophthalmology.** Ann. di ottal. e clin. ocul. **81**:298-306, July, 1955.

The substances in question is a new anesthetic for injection. Intravenous injection of the substance in rabbits demonstrates a higher toxicity than that of novocaine, while the anesthetic effect on the cornea is superior when applied locally. Side effects like modification of the pupillary diameter, changes of ocular tension or alteration of the corneal epithelium are absent. (2 references) John J. Stern.

4

PHYSIOLOGIC OPTICS, REFRACTION, COLOR VISION

Bier, Norman. **The correction of subnormal vision—a new development.** Am. J. Optometry **32**:470-486, Sept., 1955.

Clinical methods of fitting telescopic lenses have been developed and cases cited. These visual aids deserve wide usage in rehabilitating the partially sighted. Of 100 patients 80 percent were benefited and in some cases the results were remarkable. Many patients were able to read the newspaper for the first time in 20 years. Paul W. Miles.

Chinaglia, V., and Fregnan, E. **The light sense in anisometropia** Ann. di ottal. e clin. ocul. **81**:273-297, July, 1955.

In 22 of 40 cases of anisometropia of various degrees, a difference of the adaptation curve in the eyes was found. This is not related to the type of anisometropia but to retinal or choroidal changes or amblyopia. (80 references) John J. Stern.

Györffy, I. **Correction of unilateral aphakia with contact lens.** Szemészet **1**: 29-34, 1955.

In 25 patients having one aphakic eye and good vision in the other eye, a contact lens was applied for correction to restore their binocular vision. The author claims that this goal can be attained in the majority of cases. Initially diplopia due to heterotropia often occurs but soon ceases through the simultaneous use of both eyes. The fusion is rarely diminished to such a degree that a prismatic glass is needed. After the operation for the cataract, the contact lens is better

tolerated than before it. This fact and other advantages yielded by contact glasses point up their importance.

Gyula Lugossy.

Hambresin, L. **Two cylinders, mounted on a rod, as a test for astigmatism.** Bull. Soc. belge d'opht. **108**:543-547, Nov., 1954.

A simple device for the testing of astigmatism and its use is described. Two cylinders of ½D and opposite sign are mounted on a short iron rod in such a way that the axis of each cylinder forms an angle of 45° with the rod. The axis of the cylinder is marked by a line, the rod is round so that it can be easily turned between the fingers. The author also describes his methods of refraction and recommends his little instrument for use especially in cases of low-grade simple astigmatism. (1 figure)

Alice R. Deutsch.

Lavergne, G. **Scotopic vision in car drivers.** Bull. Soc. belge d'opht. **108**:528-542, Nov., 1954.

Disturbances in night vision represents a considerable hazard in driving and frequently causes accidents. The routine examination for the testing of retinal adaptation are either time consuming or involve a more than ordinary liability to error. The advantages of the adaptometer of Goldmann and Weekers are described. With this instrument a short test of about 10 minutes may be performed satisfactorily. The test is instructive enough in most cases. Nevertheless, in doubtful cases which include poor routine performance, involvement in accidents or court testimony, an adaptation curve should be established and the resistance to glare should be established. Statements on individual drivers concerning their potential visual ability in reduced illumination should not only include an adaptation test but also visual acuity and visual fields. Visual acuity and peripheral fields might be affected by a diversity of ocular diseases which themselves influence night vision disadvantageously. (6 figures, 9 references) Alice R. Deutsch.

Lyle, K. T., and Foley, J. **Subnormal binocular vision with special reference to peripheral fusion.** Brit. J. Ophth. **39**:474-487, Aug., 1955.

A survey of the state of binocular vision existing postoperatively in 200 unselected and consecutive esotropes is reported. The findings divide the patients into three groups: 1. functionally satisfactory (binocular single vision), 20 percent, 2. subnormal binocular vision (equal or nearly equal visual acuity, normal retinal correspondence and doubtful fusion), 44 percent, and 3. grossly defective binocular vision (abnormal retinal correspondence, intractible amblyopia), 36 percent. Subjects in the large second group are thought to maintain parallelism and to develop some sense of binocularity by a fusion mechanism which links the two eyes in the area of "field overlap." Special tests of a subjective nature demonstrate the presence of peripheral fusion, but these are varied and inconclusive. Postoperative divergence is rare in groups 1 and 2 and common in group 3. (5 figures, 3 tables, 8 references)

Lawrence L. Garner.

Matthews, G. V. T. **Sun navigation in birds.** Tr. Ophth. Soc. U. Kingdom **74**: 67-78, 1954.

The author discusses the fascinating subject of bird migration and points out the remarkable consistency and accuracy with which the movements are carried out. Much evidence has accumulated that makes the hypothesis of some form of sun navigation most plausible. (5 figures, 6 references) Beulah Cushman.

Michaels, David D. **Some problems of binocular vision.** Am. J. Optometry **32**: 449-469, Sept., 1955.

This brief review of the basic problems of binocular space perception contains an excellent bibliography and points out the pitfalls still present in textbooks and recent research. Studies of binocular vision are difficult for many reasons; particularly, the person being tested cannot communicate perception—only certain reflexes or motor responses can be used. It is difficult to find terminology which with certainty distinguishes objective and sensory events, especially in the so-called projection theory. The possible physiology of fusion, disparity and depth perception is discussed. Paul W. Miles.

Pascal, Joseph I. **Retinal image in axial and refractive ametropia.** Brit. J. Ophth. **39**:380-381, June, 1955.

In corrected axial ametropia the retinal image is the same size in both myopia and hyperopia while in uncorrected axial ametropia the retinal image is smaller in hyperopia and larger in myopia than in emmetropia by about 2 percent for every diopter of error. In refractive ametropia the correcting lens makes the retinal image larger in hyperopia and smaller in myopia than in emmetropia by about 1.7 percent for every diopter of correction.
Lawrence L. Garner.

Phillips, Frank. **The treatment of amblyopia ex anopsia at six years.** Tr. Ophth. Soc. Australia **14**:119-121, 1954.

Amblyopia ex anopsia is sometimes unimproved because of poor cooperation by the parents. Occlusion may be adequately supervised and the children assisted with their education at a sight saving school.
Ronald Lowe.

Ridley, Frederick. **The contact lens in investigation and treatment. (Doyne Memorial Lecture)** Tr. Ophth. Soc. U. Kingdom **74**:377-410, 1954.

The author describes a diagnostic set of contact lenses composed of three principal contact lenses having optics of uniform thickness of 0.3 mm. and seven cap lenses of suitable range of plus and minus powers. A gonioscopy lens and a fundus viewing lens are adapted for use with the set. The use of the equipment is described 1. for measurement of corneal thickness and the depth of corneal opacities or foreign bodies where lamellar graft operation is being considered, 2. to eliminate aniseikonia and ascertain what vission is obtainable with contact lenses, 3. to determine whether an eye with a nebula may be amblyopic, 4. to facilitate the examination of the fundus and media in cases of corneal nebula and a high refractive error and in all cases of surface irregularity, 5. as an aid in the differential diagnosis of acute and subacute glaucoma, and 6. in gonioscopy and fundus examination using the fundus viewing lens, and as an aid to slitlamp examination of eyes having corneal irregularity, nebula or ulcer. Improvement of sight as opposed to spectacles is applied to: keratoconus, corneal nebulae, proposed corneal grafts, lamellar grafts, penetrating grafts. (14 figures, 7 references)
Beulah Cushman.

5
DIAGNOSIS AND THERAPY

Alberth, B., and Bálint, Á. **Treatment of opacities in the vitreous body by oscillation complexes containing ultrasound impulses.** Szemészet **2**:75-81, 1955.

After a short review of the literature, the ultrasonic "bell" devised by one of the authors (Bálint) is described. The application of the apparatus to experimental animals resulted in the clarification of opacities resulting from artificial bleeding

in three cases. In man 20 treatments were carried out, mainly in cases of vitreous opacity. The mechanism of the disappearance of the opacities is attributed to the following factors: 1. hyperemic effect, owing to the local acceleration of the blood current and to increased permeability the exchange of aqueous humor is accelerated, 2. the colliquating action of ultrasound temporarily diminishes the viscosity of the vitreous body whereby the opacities sink to the bottom, 3. temporary reduction of surface tension is attended by the increase of permeability in the membrane of the vitreous and in the cell membrane of the cells lodging in the vitreous, 4. partial rehydration of precipitated proteins occurs, also they disintegrate whereby soluble substances of smaller molecule size arise and, 5. part of the cells having given rise to the opacity may undergo cytolysis.

Gyula Lugossy.

Barraquer Moner, Joaquin. **Pharmacodynamic potentiation in ocular surgery.** Rassegna ital. d'ottal. **24**:44-48, Jan.-Feb., 1955.

Increased potentiability of drugs has two aims, namely, 1. to avoid disturbance of equilibrium of the neurovegetative system and, in consequence, that of the neurovascular-humoral system, and 2. to obtain general and ocular tranquility which permits freedom and security of operation. Increased effectiveness of medication is achieved by repetition of small doses of drugs similar to those employed in this country but with different names. Pre- and postoperative medication is thoroughly discussed.

Eugene M. Blake.

Burn, R. A., Hopkin, D. A. B., Edwards, G., and Jones, C. M. **Sedation for ophthalmic surgery. Combination of chlorpromazine, promezathine and pethidine.** Brit. J. Ophth. **39**:333-342, June, 1955.

A combination of three drugs, chlorpromazine (largactil), promazine (phenergan) and pethidine was given intravenously or intramuscularly as a premedication for ocular surgery under local anesthesia and the results were compared to those obtained by standard premedication (luminal gr. 3) in a series of 89 cases including practically all phases of intra- and extraocular surgery. It would appear that an anesthetist is mandatory here since experience with these drugs can be quite alarming. A marked fall in blood pressure, a tachycardia lasting ten or more minutes, and the appearance of a patient with bloodless lips and marked pallor could be quite disconcerting to one inexperienced with the effects produced here. Except for the results noted in strabismus, the general, perfect relaxation and absence of anxiety and apprehension, seems to recommend the use of this preparation. In strabismus a sudden uncontrolled and exaggerated movement is frequently noted when a painful stimulus occurs, as is noted in pulling on the extraocular muscles. The immediate postoperative recovery of these patients is similar to that noted under ordinary conditions. (2 tables, 5 references) Lawrence L. Garner.

Csapody, I. **Unusual surgical problems.** Szemészet **1**:5-11, 1955.

1. Destruction of a chamber cyst in an aphakic eye with trichloracetic acid is described. Complete vision (5/5) was present even in the fifth year after operation. 2. Because a migrant cataract residue blocked the pupil of the sitting patient, his vision was impaired; when lying down his sight was good. Submerging of the residue in the vitreous body was imminent. Extraction took place in the sitting patient. In the last two years

the vision has been good. 3. Temporary blindness occurred during operation on the lacrimal sac. Amaurosis was due to intraorbital hemorrhage. Orbitotomy resulted in immedaite restitution.

Gyula Lugossy.

Dekking, H. M. **The flicker fusion frequency as a method of diagnosis of vascular disturbances.** Tr. Ophth. Soc. U. Kingdom **74**:509-512, 1954.

It is assumed that fusion frequency is a retinal function and therefore very susceptible to metabolic disturbances in the retina. A rise of one-half to one cycle per second is considered significant in the literature. The author made 1,500 measurements on 200 normal people and found that 15 determinations were necessary to make a difference of one cycle per second significant. The investigation was carried out at the request of the obstetrical department to find out if this method could be used to detect early stages of toxemia of pregnancy before other clinical signs were in evidence. It was found to be of value in predicting eclamptic complications. The question remained as to the location of the vascular spasm, whether it was located in the retina, brain or optic nerve. (6 references)

Beulah Cushman.

Doggart, J. H. **Failing vision in childhood.** Tr. Ophth. Soc. Australia **14**:62-69, 1954.

If a child has failing vision with no evidence of trauma, or no refractive error (especially no myopia), there will often be evidence of other disease; not necessarily a rise in temperature or an acute illness, but there will probably be evidence of disease elsewhere. There is always the possibility of some slight insidious degeneration in the eyes themselves. If the vision is undoubtedly failing and one finds no evidence of disease, the outlook is sombre and the patient must be kept under close observation. Some lesion of the central nervous system might be beginning. If an ocular palsy develops, however slight, the outlook is serious because unlike adults the child who manifests an ocular palsy has some very definite lesion. Frequently the cause will be a neoplasm of the brain stem or cerebellum.

Ronald Lowe.

Fernandez, R. H. P., Edmonds, O. P., and Hunt, T. A. **Binoc ar diaphragm.** Brit. J. Ophth. **39**:343-348, June, 1955.

In ordinary vision testing both eyes are kept open, yet the visual acuity is usually tested with one eye occluded. The authors present a method of testing the distant visual acuity under binocular conditions by utilizing the principle of the Bishop Harmon diaphragm. The patient uses both eyes to look through a 4.5 cm. aperture in a diaphragm located midway between the patient and the Snellen chart. The test detects hyperphorias of 0.75 diopters or more and esophorias of 3 to 5 diopters. The patients in whom binocular vision differs from that found in the indivdual eye are easily detected. The authors feel that this method is a means of making the trial test easier for the patient. (6 figures, 1 table and 4 references)

Lawrence L. Garner.

Jackson, C. R. S. **Calibration of tonometers.** Brit. J. Ophth. **39**:368-373, June, 1955.

The author presents four possible methods of recalibrating inaccurate Schiøtz tonometers and advises a standardization of manufacturers so that all Schiøtz tonometers will conform to a set standard with a minimum of deviation. The best method seems to be that published by Friedenwald who uses the living eye (human) to construct a distribution curve. The use of a rubber membrane

manometer produced results which differed from those obtained on the eye and a comparison of the two produced misleading results. The cannulated human eye method did not seem practical and the author recommends a detailed physical examination of the instrument with application of mathematical correction factors to the standard conversion chart as published by the American Academy of Ophthalmology and Otolaryngology. (Decennial Report on the Standardization of Tonometers, 1954.) (2 tables, 5 figures, 4 references)

Lawrence L. Garner.

de Jaeger, A., Bernolet, J., and Lemahieu, F. **Localization and extraction of intraocular foreign bodies.** Bull. Soc. belge d'opht. **108**:576-581, Nov., 1954.

The authors' methods of localization and extraction of intraocular foreign bodies are described. They have used this technique successfully since 1935. The markers consist of four lead beads sewn to the limbus. (7 references)

Alice R. Deutsch.

Németh, L. **Ophthalmologic relationships of allergic vessel diseases with regard to the rosacea keratitides.** Szemészet **1**:41-45, 1955.

The significance of allergic vascular phenomena have been particularly pointed out by recent investigations. Bacterial allergens often give rise to conspicuous hyperergic inflammations and lesions in the vessels of the eye also. Allergens of other character, too, may produce similar vascular phenomena in the eye. Therefore, endogenous hormonal allergens may also be taken into account. In rosacea inflammations, attended by conspicuous vascular symptoms, allergic factors undoubtedly have a role. In order to demonstrate this factor, the author performed intradermal tests with 25 patients suffering from severe rosacea keratitis. According to the results, endogenous hormonal allergy was suspected in about one fourth of the cases. Oversensitivity to testosterone and estrone occurred with about the same frequency, or perhaps more frequently with the former drug. No sex difference was observed. The male hormone gave rise to oversensitivity in women as did the female hormone in men. The author tried to detect and control the changes of the vessel wall during desensitization by means of slitlamp. Thus, if rosacea keratitis does not respond to usual therapeutic procedures, endogenous hormonal allergy should be taken into consideration. If this be demonstrated by intradermal test, cautious desensitization with the hormone may result in healing or, at least, a longer period free from recurrence.

Gyula Lugossy.

Pettinati, Sergio. **The value of radiologic studies of the orbit.** Rassegna ital. d'ottal. **24**:66-69, Jan.-Feb., 1955.

The author stresses the many ways in which the radiologist may be of great diagnostic aid to the ophthalmologist, and the many new procedures with which the latter should be familiar. He emphasizes the value of studies of the optic canal, the accessory sinuses and the lacrimonasal bony structure. Great help is found in the study of orbital tumors, in cerebral arteriography, and in orbital venography. Newer, more visible and less dangerous radio-opaque substances are proving of great value. Closer cooperation between the radiologist and the ophthalmologist will aid in creating and developing finer techniques of value in the many puzzling conditions encountered by all. Eugene M. Blake.

Reichling, Walther. **The eyed probe in ophthalmic operations.** Klin. Monatsbl. f. Augenh. **127**:68-74, 1955.

A spatula or probe is described which is fenestrated at its end and of varying width. It can be held against the lip of a wound and a needle carried through it without the help of a forceps. This maneuver is less traumatizing and especially advisable in corneal surgery. (13 figures)

Frederick C. Blodi.

Riehm, W. **Focal tuberculosis of the eye and its treatment from an immunological point of view.** Klin. Monatsbl. f. Augenh. **127**:1-12, 1955.

This is a review article which concerns itself with ocular inflammations presumably caused by the presence of tubercle bacilli damaged to such an extent that they can no longer proliferate. Among these conditions are phlyctenular geratoconjunctivitis, sclerokeratitis and tuberculous uveitis. The diagnosis remains difficult. Other etiologic factors should be excluded and certain clinical features (mutton-fat precipitates, avascular nodules) have to be evaluated. A tuberculin test should be done with care to avoid any damage (focal and local reaction). In treatment the author is a partisan of extreme conservatism. He advises bed rest, vitamins and adequate diet, but warns against any systemic and local treatment that could reactivate the focus. (4 references)

Frederick C. Blodi.

Roper-Hall, M. J. **Orbital implants.** Tr. Ophth. Soc. U. Kingdom. **74**:337-346, 1954.

An implant made of perspex in hemispherical form, 21 mm. in diameter, is surmounted by a ring on its flat surface and supported at four points so as to leave four tunnels for the rectus muscles. It is retained well and movement is sufficient for cosmetic purposes. Incorporation of a magnet offers some prospect of overcoming many of the difficulties in obtaining integration of movement. (2 figures, 1 table, 13 references)

Beulah Cushman.

Sztrilich, L. **The serology of trachoma.** Szemészet **2**:91-93, 1955.

Paul-Bunnel's hemagglutination test was performed by the author in 260 patients of whom 129 had trachoma, 12 healed trachoma, and 119 were healthy controls. In 83.7 percent of the trachoma cases the test was positive, while 91.7 percent of the healed persons and 77.3 percent of the controls yielded a negative test. The error of the test is about 16 percent, which is no greater than that which occurs with other serologic reactions. Although the test is not specific, the fact that it is positive in 83 percent of the trachoma cases and negative in 77 percent of the controls is, in the view of the author, an undoubted proof that trachoma is, like other infections, accompanied by immunobiologic processes. Trachoma is a local specific infection, nevertheless it elicits general defensive reactions. Apparently a change charcteristic of trachoma comes about, the serum of the individuals with trachoma displaying a behavior different to that of normal persons.

Gyula Lugossy.

Wigley, S. C., and Egan, J. B. **Pulmonary infection in Sjögren's disease. (keratoconjunctivitis sicca). A report of a fatal case.** M. J. Australia **2**:371-374, Sept. 3, 1955.

The report describes protracted pulmonary infections from antibiotic-resistant staphylococci that followed initial treatment with A.C.T.H. in hospital. The original infection was probably by a penicillin-resistant "hospital" staphylococcus enhanced by the A.C.T.H. and by dryness of the bronchial tree. The ability of the staphylococcus to adapt itself to ther-

apeutic environments is illustrated. Decisions to use A.C.T.H. or cortisone in Sjögren's Disease or to control an accompanying polyarthritis must be made while appreciating the possibility of respiratory tract infection with drug resistant organisms. (7 references)

Ronald Lowe.

Young, J. Horton. **The magnetic intraocular seed implant.** Tr. Ophth. Soc. U. Kingdom **74**:469-476, 1954.

The author presents an acrylic magnetic implant with a horseshoe magnet of great strength, designed especially to meet the needs of an irregular socket. The attachment of the prosthesis depends upon the anchor magnet within the implant and its corresponding magnet within the prosthesis, assisted by the irregularities of the posterior socket wall. Large and small implants are made. (2 figures)

Beulah Cushman.

6

OCULAR MOTILITY

Fogitt, K. Dean. **Recession-lengthening of medial recti for convergent squint. A preliminary report.** Brit. J. Ophth. **39**:488-494, Aug., 1955.

An operation is described which is particularly suited to the severe esotrope whose medial rectus muscles are such that under general anesthesia the surgeon finds it quite impossible to abduct the eye manually. Subjects who have marked spasm of accommodation and convergence with congenital convergent strabismus would be candidates for the above procedure. The medial rectus muscles are recessed, lengthened and weakened. The medial rectus is exposed posteriorly as far as possible. A strong artery forceps is applied 16 mm. posterior to the insertion to clamp two-thirds of the muscle for at least 30 seconds. Unless this is done correctly and the muscle then carefully cut, bleeding can be considerable. A second myotomy can be performed 8 mm. anterior to the first on the opposite side of the muscle. The locations of the myotomies, being posterior to the equator, are such that adhesions should not effect the results, as have been noted in myotomies performed more anteriorly. Overcorrection is rare if the indications and contraindications are observed. A schematic table is furnished giving the surgeon interested in this procedure an approximate guide. The recession-lengthening procedure has, to date, been employed for four years and only in very young children. It is therefore too early to evaluate for possible late effects. The method offers an excellent solution for strabismus fixus. (2 figures, 1 table, 1 reference)

Lawrence L. Garner.

Maude, J. **Diplopia following thyroidectomy.** Tr. Ophth. Soc. Australia. **14**:122-124. 1954.

A case report with some puzzling features is reported. (2 figures)

Ronald Lowe.

Nutt, A. B. **The clinical significance of the orbital fascia.** Tr. Ophth. Soc. Australia **14**:11-29, 1954.

Defective ocular movements are frequently not due to congenital paralysis or paresis of the extraocular muscles, but more commonly the defects are mechanical within the orbit (such as developmental defects in the muscle insertions or abnormalities in the orbital fascia). Of 457 patients with convergent squint 49 percent showed weakness of one or more of the vertically acting muscles. The most common developmental abnormalities are 1. abnormal muscle slips, 2. muscle fibres in the intermuscular membrane and 3. foot plates at the muscle insertions. Case histories are presented illustrating fused

check ligaments, adhesions between muscles and shortened facial sheaths. The forced duction test is most important. At operation abnormal fascial bands are divided and the eye can be made to move freely but unfortunately the late results of some cases are not completely satisfactory probably because fibrous tissue tends to reform. (14 figures)

Ronald Lowe.

Nutt, A. B. **Observations on the surgical treatment of ocular vertical deviations.** Tr. Ophth. Soc. Australia **14**:40-61, 1954.

In the preceding two years the author has performed operations on vertically acting muscles 100 times. The primary deviations of 150 cases show the superior oblique to be the commonest muscle with underaction. Cases illustrating the principles of treating various congenital vertical deviations are presented. Surgery was planned according to the disordered anatomy and physiology although the best method of weakening an overacting inferior oblique had not been determined. Operations were sometimes contraindicated.

The paper contains 18 excellent illustrations each consisting of groups of photographs demonstrating the cases described, usually including preoperative and postoperative head tilts, ocular movements and Hess screen charts. (18 figures, 1 table)

Ronald Lowe.

O'Connor, R. **The Cinch operation.** Brit. J. Ophth. **39**:495-502, Aug. 1955.

The author desires to present the technique, applications and advantages of his muscle shortening operation, since descriptions in most textbooks seem to discourage interest in it. A detailed description of the technique is given. The severe reactions and prolonged convalescence noted in most tests is explained by the author as being due to poor technique. (12 figures, 1 table, 11 references)

Lawrence L. Garner.

Weekers, R., Daenen, P., and Harcourt, J. **The etiology of concomitant squint. A study on identical twins.** Bull. Soc. belge d'opht. **108**:547-553, Nov., 1954.

The case histories of two sets of identical twins are discussed. The first pair of twins were eight-year-old, highly hypermetropic girls. Both girls had a convergent squint of the left eye. One girl had crossed eyes since birth. The amblyopia of her left eye could not be improved. The other girl started to squint when she was two and one-half years old. Her amblyopia could be improved and good binocular function achieved. The amblyopia and the squint were considered to be hereditary. The second pair of identical twins were three and one-half-year-old girls. Their refraction was not similar. One child was highly myopic in both eyes. The other was only myopic in one eye. The nearsighted child had an alternating, convergent squint, based on sensorial elements, not on genetic factors. The other child only used the less nearsighted eye for fixation. Her eyes were straight. (2 figures, 5 references)

Alice R. Deutsch.

7

CONJUNCTIVA, CORNEA, SCLERA

Dorzee, J. **Acrylic corneal prosthesis.** Bull. Soc. belge d'opht. **108**: 582-593, Nov., 1954.

The author describes his modified intracorneal acrylic prosthesis and his surgical techniques. The operation was performed only on hopelessly scarred corneas. After a more or less stormy period of recovery the prosthesis was usually tolerated. In his discussion of the communication, Legrand points out the difficulties

and hazards of these procedures and the uncertainty, in the present knowledge, concerning the capacity of the cornea to endure foreign bodies. However, he also recognized the importance of the work. (7 figures) Alice R. Deutsch.

Mann, Ida. **Trachoma in the United States of America.** Tr. Ophth. Soc. Australia **14**:125-126, 1954.

A brief account is given of oral sulfonamide treatment. Ronald Lowe.

Ormsby, H. L. **Ophthalmia neonatorum.** Canad. M. A. J. **72**:576-580, April 15, 1955.

A four-year study encompassing 8,418 births is reported. Four large series are described: one in which no prophylactic treatment was given, one each in which 1-percent silver nitrate, 10-percent sulfacetamide, and a sulfathiazole-sulfadiazine mixture were used. The results are discussed in relation to a large series treated with penicillin. It was found that none of the methods appeared to have any effect upon the incidence of inclusion body conjunctivitis. The series with no prophylaxis had a 0.24 incidence of gonococcal infection, which is high. The author feels that the Credé method is still the prophylaxis of choice and should be continued despite its incidence of chemical conjunctivitis. The chief reasons for this are the instability of other preparations, and the sensitivities which they may induce. (5 tables, 13 references)

Harry Horwich.

Rumbaur, W. **The diagnosis of trachoma.** Klin. Monatsbl. f. Augenh. **127**:58-64, 1955.

The author reports an acute epidemic of trachoma occurring about 15 years ago in Breslau and originating from the infected eyes of an ophthalmologist. This physician had an acute trachoma which remained undiagnosed for several months and more than 300 persons were infected. The first manifestations were merely subjective symptoms of photophobia and smarting. The first sign was frequently a ptosis. Only after a few days did the edema and injection of the upper fornix appear. Later the typical follicles developed. (12 references)

Frederick C. Blodi.

9

GLAUCOMA AND OCULAR TENSION

Beretta, Francesco. **The irido-corneo-scleral canalization in the surgical treatment of glaucoma.** Ann. di ottal. e clin. ocul. **81**:307-316, July, 1955.

The author describes his antiglaucoma operation which he calls irido-corneo-scleral canalization in order to distinguish it from sclerecto-iridoencleisis. After formation of a limbus-based conjunctival flap, trephining is performed as in an Elliot operation, and a peripheral portion of the iris is pulled out of the sclero-corneal opening where it is incorporated in the wound and covered by the conjunctival flap. The method is a combination of Elliot's and Lagrange's operation. (33 references) John J. Stern.

Csillag, F. **Action of operations for glaucoma.** Szemészet **1**:34-41, 1955.

The mode of action of glaucoma operations is reported on the basis of data in the literature. The histologic and gonioscopic examinations carried out by Elschnig, Vannas, Barkan, Bangerter, Goldmann and Löhlein, have revealed the mechanism of the effect of cyclodialysis. The aqueous humour oozing backwards through the communication canal accumulates beneath the choroid whereby the latter becomes detached. Kiss has shown that the aqueous becomes, while oozing backwards, absorbed by the ciliary plexus, as a sign of enhanced drainage,

whereby hypotonia results. Vannas obturated in a similiar case the communication canal by diathermic coagulation and observed the sudden rise of tension from 8 to 70. Cyclodialysis, iridectomy, the operations of Lagrange, Elliot, and Stallard, and anterior sclerotomy, are often followed by detachment of the choroid and, at the same time, by good results of the operation. Considering that these operations do, like cyclodialysis, bring the two cavities into communication, it is clear that their action consists essentially in backward filtration. Further, softening of the eyeball will, after these operations, take place only in those cases and to the degree in which the backward filtration of the aqueous humour has been rendered possible by the operation.

Gyula Lugossy.

Goldmann, H., and Schmidt, T. **The testing and standardization of Schiötz tonometers.** Klin. Monatsbl. f. Augenh. **127**:12-24, 1955.

The authors describe the first European testing station which was established at the clinic in Berne (Switzerland). The testing of the tonometers and their evaluation follows quite closely the standards established by the Committee on Standardization of Tonometers of the American Academy of Ophthalmology and Otolaryngology. A comparatively simple set of instruments will suffice for this testing. It is strongly suggested that other countries do likewise so that results can be compared and the new conversion table can be used. (9 figures, 2 tables, 14 references)

Frederick C. Blodi.

Goldsmith, A. B. J. **Cyclodiathermy.** Tr. Ophth. Soc. U. Kingdom **74**:41-50, 1954.

The author attempts to assess the value of cyclodiathermy operations of which he recognizes three types. Perforating diathermy or electrolysis is applied in a concentric band not more than 5 mm. from the limbus around one-half of the globe at one sitting; the other half is done later if the reduction of tension is not satisfactory. The number of punctures may be anything up to 200. Surface diathermy is applied without reflection of the conjunctiva to the ciliary region within 5 mm. of the limbus.

The second type of operation has as its object the diminution of blood supply to the ciliary region in order to lessen the amount of aqueous humor produced. This is done by obliterating the long posterior ciliary arteries and some of the anterior ciliary arteries by diathermy electrolysis or the introduction of special electrodes through scleral incisions in the horizontal meridian of the eye in the region of the insertion of the internal and external rectus muscles.

The third type, used by Arruga and first elaborated by L. and R. Weekers is retrociliary diathermy in which surface heat is applied to the sclera in a band concentric to and 6 mm. from the limbus in the region of the pars plana of the ciliary body or at the level of the ora serrata.

The author found the third type most satisfactory and placed 12 to 16 applications evenly spaced with a 1.5 mm. electrode and an 85 ma. current for 6 to 8 seconds (Keeler diathermy machine) with firm pressure maintained on the eye with the electrode. The best results were obtained when the initial pressures were not over 35 mm. and satisfactory results were obtained in glaucoma secondary to uveitis, aphakia or retinal venous thrombosis of various types or after keratoplasty. (23 references)

Beulah Cushman.

Handl, O. **The influence of subconjunctival cortisone injections on fistulating**

operations. Klin. Monatsbl. f. Augenh. **127**:24-29, 1955.

Two series of 94 eyes after fistulating operations in glaucoma are compared. In one series the eyes received immediately 5 to 10 mg. cortisone subconjunctivally after the operation. There was no difference between the two series as far as postoperative intraocular pressure, visual acuity and visual fields were concerned. In three cases the drugs entered the wound and even the anterior chamber, causing a severe secondary glaucoma in one eye. (6 tables, 4 references)

Frederick C. Blodi.

Kleinert, Heinz. **Anemia as the basis for the increased intraocular pressure in glaucoma.** Klin. Monatsbl. f. Augenh. **127**:29-39, 1955.

The author believes that the resistance to outflow in glaucomatous eyes lies in the intrascleral venous plexus. The pressure on these veins is exerted by an edema in the sclera caused by a vascular disturbance in this area. It is assumed that an obliterating, capillary sclerosis, as described for other regions in glaucomatous eyes, may precipitate the scleral edema. Various observations, previously published by the author, seem to confirm this hypothesis. The diurnal variation of scleral rigidity, the constriction of the anterior ciliary arteries before an acute rise in pressure and the decreased filling of the epibulbar veins during an attack are factor which support this hypothesis.

The author tried to treat some cases of chronic glaucoma with the local application of a mild vasodilator. In spite of the fact that no miosis occurred, the intraocular pressure could be regulated quite satisfactorily. Too strong a vasodilator may on the other hand produce a rise in pressure. The beneficial effect of vasoconstrictors is thought to be due to a decreased resistance to flow in the intrascleral vessels. Even the effect of diamox is explained as a local one, decreasing the sclera edema. (23 references)

Frederick C. Blodi.

Lieb, Wolfgang. **The effect of parasympathetic drugs on aqueous veins and epibulbar vessels.** Klin. Monatsbl. f. Augenh. **127**:74-94, 1955.

The results of a series of careful and extensive animal experiments are reported. Into the anterior chamber of rabbits a dye (fluoresceine, trypan-blue and mostly Evans-blue) was injected. Before, during and after the injection the limbal area was observed and photographed with a stereomicroscope in a magnification of 80 to 160 diameters. One drop of the drug was instilled into the conjunctival sac and the effect on the vessels was again recorded. The concentration of the drug was one which is usually used in glaucoma therapy.

Doryl, eserine and mestinone (an eserine derivative) caused an initial vasoconstriction. But these three drugs and DFP soon lead to a marked vasodilation which increases the flow in the aqueous veins and may contribute to the pressure-reducing effect of these drugs. A low concentration of parasympathomimetic drugs is advised; a high concentration may have a toxic effect on the vessels. (10 figures, 1 table, 57 references)

Frederick C. Blodi.

Orbán, T., and Bárkány, B., Jr. **The effect of testicle denervation and sympathergic drugs on intraocular tension.** Szemészet **2**:69-73, 1955.

The authors denervated the left testicle of 14 sexually mature rabbits. On the left eye of 11 animals lasting increase of tension occurred. In three rabbits bleeding occurred during operation. In these tension increase was insignificant and short-lasting. The tension increase produced in

this way is augmented by the excitation of the sympathetic nervous system.

Gyula Lugossy.

Schirmer, R. **Experiences with an instruction sheet for glaucoma patients.** Klin. Monatsbl. f. Augenh. **127**:99, 1955.

Such a sheet was originally designed and advocated in the monograph on glaucoma published in 1952 by Klin. Monatsbl. f. Augenh. The author uses it in his practice and finds it extremely useful. (2 references) Frederick C. Blodi.

Smith, Redmond. **Gonioscopy in glaucoma.** Tr. Ophth. Soc. U. Kingdom **74**:171-185, 1954.

The author reviews the anatomic findings in gonioscopic examination and tries to resolve some of the contradictory statements. He shows that there is confusion in the literature between the concepts of transient closure of the filtration angle and peripheral anterior synechiae. Transient closure of the filtration angle can occur in angles of medium width in addition to narrow angles. (11 figures, 9 references) Beulah Cushman.

Stepanik, J. **Tonography and glaucoma research.** Klin. Monatsbl. f. Augenh. **127**: 40-50, 1955.

This is a review on various aspects of tonography. Its history prior to Grant's method is discussed. The many results in normal and glaucomatous eyes, in secondary glaucomas, after operations and in provocative tests are described. The margins of error caused primarily by changes in scleral rigidity are emphasized. (1 table, 41 references)

Frederick C. Blodi.

Weekers, R., and Watillon, M. **Indications for the use of diomox in ocular hypertension.** Bull. Soc. belge d'ophth. **108**: 507-520, Nov., 1954.

The effect of diomox on the formation of the aqueous was investigated and the results on its benefits alone and in combination with other drugs and with retrociliary diathermy in healthy eyes, in narrow-angle glaucoma, in wide-angle glaucoma and in secondary glaucoma of various etiology were tabulated after careful examination and evaluation. When given in doses of 125 mg. four times daily, it reduces but does not stop the production of aqueous; the aqueous veins remain visible, even during the time of the most pronounced depression of the ocular tension. Adrenalin in 2-percent solution was the other drug used but, being a powerful sympathomimetic agent, its indications were limited. Diomox supposedly acts by inhibition on carbonic anhydrase. The mode of action of 2-percent adrenalin inside the eye is not completely clarified. Retrociliary diathermy probably causes nonspecific neurovascular changes. Diomox alone and in combination with miotics or sympatholitic drugs is very effective in most cases of primary and secondary glaucoma except in cases of thrombosis of the retinal veins and rubeosis iridis. It cannot be used continuously for very long because it loses its effectiveness and because of potential signs and symptoms of intolerance and intoxication. Adrenalin solution may be used for years in wide-angle glaucoma and in secondary glaucoma. It is contraindicated in narrow-angle glaucoma because a mydriasis increases the resistance to the outflow of aqueous. A well-planned and executed retrociliary diathermy often reduces the ocular tension for long periods and is recommended as an additional operation in chronic cases where indicated. (4 tables, 1 graph, 15 references)

Alice R. Deutsch.

10

CRYSTALLINE LENS

Chinaglia, V., and Amidei, B. **Crystalline substances in the lens.** Rassegna ital. d'ottal. **24**:3-32, Jan.-Feb., 1955.

The authors describe two cases of crystal formation seen biomicroscopically. The crystals appeared as iridescent particles of various form and color. In one case the condition developed after extraction of a senile cataract which pursued an irregular postoperative course because of retained lens matter. The second case was one of an immature senile cataract of the coronary type.

In the first case the authors instituted chemical, chromotographic, and crystallographic studies and were able to recogize diverse crystals which were of three types, namely, fatty (cholesterol), protein (probably tryptophan and aspartic acid), and an inorganic substance (sodium chloride). The authors claim that these two cases, so dissimliar in chemical, biomicroscopic and pathogenetic features, may be helpful in the understanding of the biochemistry of crystals developing in the lens. (10 figures, 84 references)

Eugene M. Blake.

Duthie, O. M. **The surgical treatment of ectopia lentis.** Tr. Ophth. Soc. U. Kingdom **74**:329-336, 1954.

The author describes the surgical procedure for ectopia lentis. In one type of operation the lenses are steadied with a Sinclair guard and with capsule forceps, and the lens is gently rocked and slowly withdrawn.

In a second group the lens was spooned out. (2 tables, 7 references)

Beulah Cushman.

Holland, Sir Henry. **Facts, fallacies and failures in cataract surgery.** Tr. Ophth. Soc. U. Kingdom **74**:423-434, 1954.

The author writes about his work in the eye clinics on the Northwest Frontier of India for 54 years which is being carried on now by his second son. In their clinic they favor Smith's intracapsular technique with very definite contraindications such as: congenital cataracts, juvenile cataracts; eyes with high tension, complicated and traumatic cataracts, cataracts in large, prominent eyes and in cases in which legitimate pressure does not make the lens present and does not rupture the zonule. The failures in cataract extraction are usually the result of faulty operative techniques which includes faulty incision or a surgical iridodialysis. Accidents or complications during the operation which bring about failure include luxation of lens into vitreous, prolapse of vitreous, prolapse of iris, and hemorrhage. Complications often follow faulty technique in anesthetizing the eye or the patient and the surgeon should write on the history not "bad patient" but "bad surgeon." In such patients a general anesthestic is indicated. Loss of eye due to infection is rare; during the last season one eye was lost because of primary infection in 1,672 patients. In preparation for the surgery thorough conjunctival irrigation with (1-2,000 hydrarg. perchloride) is done and before the dressing penicillin ointment and sulphathiazole powder are put into each eye. A movable speculum is used, a complete iridectomy, and a forceps or Smith delivery is done and no stitches are used No difference was found in the appearance of the vitreous surface after a large series of Arruga and Smith operations. Forceps delivery is more easily accomplished with the patient looking forward, and the Smith operation when the patient looks up.

That detachment of the retina occurs more often after intracapsular operation is a fallacy. Loss of vitreous is not a frequent complication in the Smith operation except for those who have had little experience. Postoperative nursing had little effect on the outcome in their experience of over 70,000 cataract operations. The patient has been allowed to get up and walk to the lavatory guided by an attendant, usually a relative. The simpler the technique and the less the eye

is handled the better is the chance for recovery. The only instruments introduced into the eye in the Smith operation is the cataract knife and the tip of the iris forceps. Beulah Cushman.

Reed, Howard. **Keratome or knife incision for cataract? Assessment of 180 cases.** Brit. J. Ophth. **39**:353-361, June, 1955.

A comparison between keratome plus scissors and Graefe knife section was again made and no significant difference was found. The choice of method is strictly a matter of individual preference and ability. The matter of the various types of corneoscleral suture methods in relationship to the type of incision has yet to be thoroughly evaluated. (11 tables, 11 references) Lawrence L. Garner.

11

RETINA AND VITREOUS

Calmettes, Deodati, and Amalric. **Atypical tuberculous chorioretinitis.** Bull. Soc. belge d'opht. **108**:459-464, Nov., 1954.

A 45-year-old woman gave the history of recurrent tuberculous disease ever since childhood. Cervical adenitis, when she was 10 to 15 years old, was followed by bronchopulmonary episodes and tuberculous peritonitis. There was no history of visual impairment or inflammations of the eye. The ophthalmologic examination was requested because of beginning presbyopia. At this time the radiologic examination showed a diffuse cicatrization and multiple fine calcifications of both lung fields, characteristic of the micronodular form of tuberculosis. The anterior segments of both eyes, the discs, and the retinal vessels were normal. Numerous yellowish white, round and sharply outlined patches covered the periphery and paramacular areas of both fundi, with a tendency to conglomeration and mild pigmentation around the posterior pole. No changes in these lesions were seen during an observation period of two years. In spite of the fact that the fundus picture resembled retinal capillarosis or colloid degeneration, the authors considered it to be a part of a low-grade hematogenous infection. The mild character of this disease was remarkable since the episodes occurred during the preantibiotic period. The possibility of an allergic toxic reaction in contradistinction to a microbial dissemination as in miliary tuberculosis offers a possible explanation. (2 figures) Alice R. Deutsch.

Davenport, R. C. **Treatment and prognosis of changes at the macula.** Tr. Ophth. Soc. U. Kingdom **74**:269-280, 1954.

The author discusses prognosis of macular changes dividing them into dry and wet forms. The "dry" lesions are those that are bilateral and cover the pigmentary disturbances, many degenerative states, and myopic atrophy. The "wet" variety includes the retinal inflammatory lesion, inflammatory choroidal lesion with edema at the posterior pole, and the degenerative lesions with deep hemorrhage and exudation, all of which have a bad prognosis. Beulah Cushman.

Evans, P. Jameson. **The significance of changes at the macula.** Tr. Ophth. Soc. U. Kingdom **74**:253-261, 1954.

The author discusses the significance of changes at the macula. They may be the result of underlying changes in the circulation or of tissue metabolism and the changes may be associated with spontaneous absorption of blood vessels, which may have a familial incidence. The choroidal circulation plays an early part in a large number of degenerative retinal conditions. (33 references) Beulah Cushman.

François, J., and Poelman, A. **The treatment of bilateral retinoblastoma.** Bull. Soc. belge d'opht. **108**:594-612, Nov., 1954.

Bilateral retinoblastoma is not only a grave medical but also a social problem; because of the better chance of survival in cases of unilateral retinoblastoma and because of a certain hereditary tendency of this disease a steady increase in bilateral disease has been observed during the last years and an even greater number of afflicted children is expected to be found in the future. Seven case-histories are reported in detail with a discriminating review on the course of the disease in each patient and a critical evaluation of the treatment. Of those seven patients only one child recovered. This child had an isolated nodule about the size of the disc in the second eye. Transscleral diathermy was used, as Weve recommended in tumors not larger than 4dd., combined with X-ray-therapy. All the other eyes were lost in spite of extensive radiotherapy, probably because the disease had progressed too far before treatment was begun. Three children died, one of local metaplastic sarcoma, the second from cerebral hypertension and hyperemia following intensive X-ray therapy in a very young infant; the third child succumbed to aplastic anemia. Nitrogen-mustard was used without result in one very advanced case.

The therapuetic success depends on the distribution of the tumor. If more than one half of the retina is involved, conservative treatment fails. Diathermy coagulation after Weve was recommended in small lesions, X-ray-therapy combined with chemotherapy was thought to be better than X-ray treatment alone. In far advanced disease Stallard's technique with scleral attached radio seeds seemed to be the method of choice. Regular fundus examinations and blood counts should be performed in every patient for many years. (9 figures, 16 references) Alice R. Deutsch.

François, J., and Verriest, G. **Oguchi's disease.** Bull. Soc. belge d'opht. **108**:465-506, Nov., 1954.

An exceptionally detailed case history of a 19-year-old Jewish boy with Oguchi's disease is presented. This was the twenty-third case observed in a non Japanese individual. The various visual functions were carefully checked and tabulated. The tabulations were critically compared. The differences and similarities to related functional and structural abnormalities of the choroid and retina are described and the specific characteristics of each group discussed item by item.

Oguchi's disease belongs among the congenital, functional disturbances and probably is a variety of the essential congenital hemeralopia. It has no relationship whatever to either the tapetoretinal degeneration or the retinitis punctata albescens. Its most conspicuous clinical manifestation is the impairment in the function of the rods, displayed distinctly by the absence of the scotopic component in the E.R.G. and is referred to a lack of interaction in the nervous layers of the retina. Abnormalities in the photopic vision include the critical fusion frequency and the basic threshhold of adaptation. The photosensitive substance of Mizuo was considered not to be in exact relation with adaptation. It might be either a waste product of substances essential to vision or a substance of the intermediate metabolism of the retinal pigments. The literature is reviewed. (18 figures, 161 references)

Alice R. Deutsch.

MacRae, A. **Congenital vascular veils in the vitreous.** Tr. Ophth. Soc. U. Kingdom **74**:187-206, 1954.

The author reports the change that had taken place in three boys with an unusual form of retinal detachment, reported with Ida C. Mann in 1951. The striking feature was the presence of thin veils of translucent tissue in the vitreous. The retina could be seen through a hole in the veil. MacRae's study and those of Thompson, Lisch, Jaeger, Juler, Trevor-Roper and Sorsby suggest that it is a sex-linked condition. Gray, delicate membranes arise from peripheral parts of the retina, come forward into the vitreous and often contain blood vessels. The disturbance is a general affection of some of the inner layers of the retina, possibly microcystic. (15 figures, 13 references)

Beulah Cushman.

Maggiore, L., and Humblet. **Clinical significance and pathogenesis of senile disciform degeneration of the macula as compared with other collagen diseases.** Bull. Soc. belge d'opht. **108**:451-459, Nov., 1954.

The polymorphism in the clinical appearance of senile disciform degeneration of the macula not only in different patients but also in the two eyes of one and the same patient is well known. On ophthalmoscopic examination one eye may show the classical edematous disc, while the other eye reveals degenerative lesions. Follow-up examinations demonstrated no essential modification in the type of fundus picture during the years and established the possibility of a common origin of lesions of various and manifold aspects, each caused by impairment of the nutrition of the retina or alteration in the capillary permeability and the blood-tissue barrier. Disturbances in circulation and physico-chemical abnormalities in the blood plasma which are characteristic of old age might promote changes in the elastic tissue which constitutes Bruch's membrane or in the interstitial collagen abundantly present in the choroid. Affection of the collagen predominantly, would favor the edematous form, affection of the elastic tissue would give rise to the degenerative variety. The hypothetical character of these conclusions is recognized. Investigation of senile disciform degeneration of the macula and related symptom complexes, like angioid streaks, has been planned at the authors' clinics. (discussers: L. Weekers, Renard, Zanen)

Alice R. Deutsch.

O'Donoghue, D., and Drury, M. I. **Diabetic retinopathy.** Tr. Ophth. Soc. U. Kingdom **74**:567-576, 1954.

Diabetic retinopathy is progressive. Its first stage is characterized by the appearance of one or more small capillary aneurisms, and the second stage by the development of punctate hemorrhages in the macular area. Exudates begin to appear as solid, soapy or waxy-looking masses in stage three, when cotton-wool patches also develop and may indicate onset of hypertension or renal damage. In stage four, visible changes in the veins occur: dilation and ensheathing, multiple thrombi, and occlusion of a central vein. In the fifth stage there are recurrent vitreous hemorrhages followed by retinitis proliferans. Retinopathy was found in 60 percent of 90 patients who had had diabetes 20 years. Retinopathy also occurred more often in the patients who had a moderate hypertension. The incidence of retinopathy was 22.8 percent in the authors' series of patients with diabetes for five years or longer and increased markedly with the duration of the disease. Control of the diabetes was good in 25 percent of the patients with retinopathy. Prognosis as to vision in stage one was good, but was bad in the other grades.

No specific treatment was available for diabetic retinopathy but strict control

of the diabetes seemed to be an important factor. Testosterone propionate and X-ray treatment directed to the posterior segment of the eye seemed to give some help. (6 tables, 18 references)

Beulah Cushman.

Ryan, Hugh. **Massive retinal gliosis.** Tr. Ophth. Soc. Australia **14**:77-83, 1954.

Cases of retinal gliosis are described. Two types are suggested according to their cell origin, those in children, where the proliferated tissue is probably mesenchymal, and those in adults, where the proliferated tissue is probably glial. The cause is possibly a metabolic toxin that results from oxygen lack. (4 figures, 3 references) Ronald Lowe.

Savin, L. H. **The significance of changes at the macula.** Tr. Ophth. Soc. U. Kingdom **74**:263-268, 1954.

Any severe disturbances in the macular area cause loss of central vision. Differentiation by the ophthalmoscopic appearance was useful in differentiating the macular pictures and some of them were known as senile macular degeneration, Fuch's black spot or Doyne's honeycomb choroiditis. Gradually the clinical ophthalmoscopic pictures have been supplemented by histologic description.

Classification is now made according to particular layers of retina involved. Deep to internal limiting membrane is the usual site of the macular pre-retinal hemorrhage. Amaurotic family idiocy affects the ganglion cell layer in the central area. Niemann-Pick disease is similar but the lipoid is sphingomyelin. In Henle's fiber layer, subject to swelling, central angiospastic retinopathy, the macular star figure, glistening, white spots, retinitis circinata, and also cysts and holes at the macula appear. No changes in the retinal elements and pigment layer, which receive their blood supply from the choriocapillaris, are found in heredodegeneration of the macula, Fuch's black spot or in eclipse blindness. Lesions of Bruch's membrane in the macular area may produce macular drusen, Doyne's honeycomb choroiditis, disciform degeneration or angioid streaks.

With central choroidal changes, the pigmented type is probably formed towards the end of fetal life and the nonpigmented the result of severe destructive inflammation about the fifth or sixth month. A third type may occur before the third month when a branch of the vasa hyaloidea becomes adherent to the lesion. Toxoplasmosis, central areolar choroidal sclerosis, choroidal hemorrhage in the central area, and macular melanoma of the choroid also result from choroidal changes in this area. (1 figure)

Beulah Cushman.

12

OPTIC NERVE AND CHIASM

Jaeger, W. **Differential diagnosis of hereditary optic atrophy in childhood.** Wiener med. Wchnschr. **105**:426-428, May 21, 1955.

The common hereditary optic atrophy is the syndrome of Leber and usually occurs in subjects near 20 years of age. Of the optic atrophies which occur in childhood, three types are recognized. In group I the optic atrophy is only one of a number of symptoms of the disease and need not always become manifest. Friedreich's ataxis is one of them and in it optic atrophy is rare. In hereditary cerebral diplegia optic atrophy occurs in about 10 percent of cases. It also occurs occasionally in amaurotic idiocy and in Schilder's cerebral sclerosis. In group II optic atrophy is a constant finding. The neurologic signs may predominate as in the very rare Pelizäus-Merzbacher syndrome, or they may merely be microsymptoms in a complex that is dominated by the optic

atrophy. Behr described such disease. The 20 cases of Behr's complicated optic atrophy which have been reported occurred predominantly in the male, beginning sometime in the first 10 years of life in patients who also had nystagmus and central scotoma. The manifestations are too multiform to allow precise differentiation. In group III, however, the diseases are sharply characterized. These are 1. a recessive congenital optic atrophy, 2. a dominant congenital optic atrophy, and 3. a dominant infantile optic atrophy. Of the first of these, the author found examples in a school for the blind. One of the second group has never been seen in his clinic (Heidelberg). As an example of the third type, almost 50 examples have been examined and the author presents a family tree of five generations. Subjects in the four most recent generations were available for examination; 35 of the more than 60 subjects were found to have this type of hereditary atrophy. (1 figure)

F. H. Haessler.

McPherson, S. D., and Ryan, S. J. **Differential diagnosis of papilledema; its importance in military medicine.** U. S. Armed Forces M. J. **6**:958-971, July, 1955.

The authors have attempted to simplify and elucidate the differential diagnosis of papilledema for military practitioners. This is to obviate the needless transfer of personnel for vast distances and loss of man-hours in hospitalization when all cases of suspect papilledema are to be checked by ophthalmologists. With fundus photographs and visual field diagrams, the findings in papilledema, pseudopapilledema, optic neuritis, drusen of the optic disc, juxtapapillary choroiditis, and medullated nerve fibers are described in detail. (8 figures, 19 references)

Harry Horwich.

Alaerts, L. A. **A case of duplicate optic nerve and central retinal artery.** Bull. Soc. belge d'opht. **108**:574-575, Nov., 1954.

A duplication of the optic nerve, central artery and permanent rests of the hyaloid artery in the right eye of a 23-year-old man is described. The pupillary reactions were normal. The vision in this eye was limited to light projection. Coloboma of the optic nerve and destructive retinal lesions with new formation of vessels are mentioned as being of differential diagnostic significance. (1 figure)

Alice R. Deutsch.

Wagener, H. P. **Tumors of the optic papilla.** Am. J. M. Sc. **230**:213-225, Aug. 1955.

This is a critical review of the pertinent literature on these rare growths. Gliomas of the optic nerve are discussed with special reference to clinical forms, cell types, manner of spread, and so on. Meningiomas of the optic nerve sheaths are typified by a dural endothelioma, and a psammomatous vascular meningioma. Lesions in neurofibromatosis are considered as oligodendrogliomas. Tuberous sclerosis and hyaline bodies in the optic disc are considered also, especially in the light of confusing the latter with papilledema. Angiomas of the optic disc and racemose hemangiomas of the retina are discussed in relation to von Hippel's disease. Carcinomatous metastases and cysts of the disc are illustrated by several examples. Finally, malignant melanomas of the optic papilla are described, and the controversy as to whether they truly arise from the disc is reviewed. (52 references)

Harry Horwich.

13

NEURO-OPHTHALMOLOGY

Bonnet, Paul. **Paralysis of the abducens nerve.** J. de méd. de Lyon **36**:505-546, July 5, 1955.

In this extensive and detailed discus-

sion the author presents the significance of paralysis of the sixth cranial nerve in neuro-ophthalmologic diagnosis. He describes the diagnostic method and considers in detail one segment of the nerve after another: the orbital portion, the segment in the cavernous sinus, the portion over the petrous portion of the temporal bone, the subarachnoid portion, the nuclear region, and the supranuclear connections. In each of these segments of the discussion a large number of diseases, pathologic processes, and disturbances of structure and function are analyzed. Not only the recognition of the nature of the disturbance, but its occurrence and significance in the study of a variety of diseases is emphasized. (5 figures)

F. H. Haessler.

Clarke, E., Beaconsfield, P., and Gordon, K. **Carotico-cavernous fistula without pulsating exophthalmos.** Brit. J. Surg. **42**:520-524, March, 1955.

Pulsating proptosis is absent in 10 to 15 percent of cases of carotico-cavernous fistula and is due to an absence of, or decreased return of blood on the ispsilateral side. This may be caused by anomalies or thrombosis of the sinus or its channels. Angiography is an important diagnostic procedure. (4 figures, 46 references)

Irwin E. Gaynon.

Dieterle, P., and Babel, J. **The diagnostic value of the simultaneous recording of electroretinogram and electroencaphalogram in lesions of the visual pathway.** Ophthalmologica **129**:245-247, April-May, 1955.

The procedure indicated in the title permits estimation of the retino-cortical conduction time which is characteristically prolonged in lesions of the visual pathways. (1 figure, 6 references)

Peter C. Kronfeld.

Holmes, John MacDonald. **The ocular symptoms of intracranial aneurysms.** Tr. Ophth. Soc. U. Kingdom **74**:549-557, 1954.

Ocular symptoms appeared in 54 patients out of 106 with intracranial hemorrhage; 22 had oculomotor paresis, 14 third nerve palsy and 8 had other nerve palsies. There was no patient with hemorrhage in whom more than one oculomotor nerve was involved. Most aneurysms can be demonstrated radiologically by carotid arteriography; 35 percent diodone solution was used by subcutaneous puncture of the common or internal carotid arteries in the neck. The first exposure was made immediately after the syringe was emptied, the second two seconds later and the third after six seconds.

Basal aneurysms of the Circle of Willis are often in close relation to the third and sixth cranial nerves. Intracranial aneurysm should be suspected when there is sudden onset of cranial nerve palsies associated with sudden severe neuralgic pain. X-ray films of the skull will reveal calcification in the aneurysms in the form of Albl's rings.

Fistulous carotid-cavernous sinus communication is usually the result of head injury; the first symptoms are usually a beating noise in the head synchronous with the heart beat and pain in the eye and forehead and there may be a rapid or gradual onset of unilateral or bilateral exophthalmos. (10 references)

Beulah Cushman.

Jaensch, P. A. **Pseudoparesis caused by convergence spasms.** Klin. Monatsbl. f. Augenh. **126**:727-731, 1955.

These spasms are usually accompanied by miosis and accommodative myopia. They are nearly always due to hysteria. Two cases are reported. A 40-year-old woman had a partial convergence spasm after a cerebral contusion and an 11-year-old girl experienced similar spasms after herpes zoster on the back. The author

believes that an organic lesion can not always be excluded and could be the cause of the spasm in these two cases. (2 figures, 8 references) Frederick C. Blodi.

Mackensen, G. **Clinical application of electronystagmography.** Klin. Monatsbl. f. Augenh. **126**:685-693, 1955.

The author uses an electroencephalograph with paper writer. One patient, a 26-year-old woman, suffered from multiple sclerosis and occasional diplopia when looking to the right. An analysis of the electronystagmogram showed that she had a supra- and internuclear paresis with dissociated nystagmus. (5 figures, 11 references) Frederick C. Blodi.

Nano, H. M., and Gofanovich, B. H. **The relation of retrobulbar neuritis to a vitamin E deficiency.** Arch. Soc. oftal. hispano-am. **15**:88-101, Jan., 1955.

The differential diagnosis of retrobulbar neuritis and the pharmacology of vitamin E are fully discussed. Three cases of retrobulbar neuritis, in which the patients improved spectacularly on the administration of Vitamin E, are reported in detail. (4 figures) Ray K. Daily.

Wendland, John P. **Some instructive manifestations of chiasmal disease.** A.M.A. Arch. Ophth. **54**:13-21, July, 1955.

Three cases are presented which emphasize certain features of chiasmal disease which may be overlooked. These features are: tumors may produce a central scotoma in one eye which simulates a retrobulbar neuritis, 2. inflammatory or toxic disease of the chiasm is more apt to give pronounced loss in visual acuity, with relatively little involvement of the remainder of the field than is a tumor, 3. tumors more often produce bitemporal hemianopic scotomas than do chiasmal inflammations, and 4. in chiasmal gliomas X-ray study reveals bilateral enlargement of the optic foramen, and other clinical features of Von Recklinghausen's disease are usually present. (8 figures, 29 references) G. S. Tyner.

ver Brugghen, Adrien. **Pathogenesis of ophthalmoplegic migraine.** Neurology **5**:311-318, May, 1955.

A case is presented which is considered to be one of typical ophthalmoplegic migraine. The patient was followed for over 10 years, with well-spaced arteriography during that time. In his discussion on pathogenesis, the writer pays tribute to Wolff and Sunderland. The former is noted for his clinical studies leading to the theory of vascular constriction followed by dilatation. The latter is famed for his laboratory demonstrations of the "sandwiching" of the third nerve by the posterior cerebral and superior cerebellar arteries; and also for his demonstrations that the pupilloconstrictor fibers lie in the superior portion of the third nerve, a fact which explains many clinical phenomena. (8 figures, 21 references) Harry Horwich.

Daenen, P., and Lambrecht, J. **Coordimeter test on ocular motility, as a diagnostic aid in myasthenia gravis.** Bull. Soc. belge d'opht. **108**:613-618, Nov., 1954.

The coordimeter of Hess-Lees or Lancaster is of considerable help in the evaluation of the prostigmin effect in myasthenia gravis. It is especially useful in mild cases when the result of the prostigmin action can only be judged by graphs because it registers the finest modifications in the balance of over- and under-action of the extrinsic ocular muscles. Two case histories with coordimeter charts illustrate the exactness of this test. (4 figures, 10 references) Alice R. Deutsch.

François, J., Haustrate, L., and Philips, A. **Unilateral congenital glaucoma and semifacial hypertrophy, Recklinghau-**

sen's disease. Bull. Soc. belge d'opht. **108**: 625-641, Nov., 1954.

Complete or partial hemihypertrophy of the face of varying degree may be the only sign of Recklinghausen's neurofibromatosis. This hypertrophy may be combined with unilateral congenital glaucoma. The occurrence of unilateral congenital glaucoma should be suggestive of either neurofibromatosis or angiomatosis. Histopathologic studies of two buphthalmic eyes revealed hypertrophy of the ciliary nerves, diffuse thickening of the choroid and proliferation of chromatophores, nodular formations in the nerve sheaths and accumulation of small oval cells. Other diagnostic clues are the appearance of taches café au lait, abnormalities in the configuration of the small wing of the sphenoid and localized tissue tumefaction. A biopsy specimen of these tumors revealed the cell arrangement in whorls characteristic of plexiform neuroma. A case history concerning a 21-month-old child is included in this study. (10 figures, 1 table, 42 references)

Alice R. Deutsch.

14

EYEBALL, ORBIT, SINUSES

Armstrong, T. M. **Delayed formation of the anterior chamber. A simple method of treatment.** Tr. Ophth. Soc. Australia **14**:117-118, 1954.

The most frequent cause is a leaking wound. A few drops of plasma are placed over the incision, then one or two drops of "Thrombin Topical" solution (1,000 units per millilitre) are added. The eye is left open for one or two minutes to allow the clot to become firm then the upper lid is lifted gently over it and left undisturbed for 24 hours. (6 references)

Ronald Lowe.

Black, George W. **Observation on the diagnosis and treatment of orbital tumors.** Tr. Ophth. Soc. U. Kingdom **74**:51-65, 1954.

The author takes as his theme the need for early and accurate diagnosis of orbital tumors. Of 18 orbital tumors similar to a group described by Reese, the author presents two patients, one a boy, 14 years of age, whose proptosis appeared three months after a blow upon his eye and who died 18 months afterwards of a myxofibrosarcoma. In the second boy, three years of age, proptosis was first noted as a drooping of the upper lid and later X-ray study showed signs of wide invasion of the frontal bone and tomography revealed the process to extend backwards 4 cm. The extent of the tumor excluded surgical treatment and with treatments with radiant energy over 33 days the proptosis was reduced and the tension stabilized for ten months.

Biopsy is often inconclusive, as the tumors frequently show great variation and it may cause dissemination. (5 figures, 1 table)

Beulah Cushman.

Czukrász, I. **Observations on Krönlein's operation.** Szemészet **1**:15-22, 1955.

The following conclusions are drawn from experience in 12 cases: 1. In cases of extensive tumor spreading along the orbital wall with diffuse infiltration of the tissues of the orbit, exenteration of the orbit must often be made as a supplement to the operation. 2. Circumscribed tumors, both solid and cystic, being lodged within or outside the muscle cone, can readily be completely removed. 3. The operation is a useful aid to the laryngologist when rhinoscopy or roentgen film is not sufficiently informative. 4. During Krönlein's operation the orbit can be reviewed and its structures can be palpated. 5. In well selected cases no intraoperative complication occurs. Intense bleeding was observed in one case only, in which a perithelioma was to be removed. 6. In cases

of circumscribed tumors which did not destroy the tissues of the orbit, the functional and cosmetic result of the operation were satisfactory. 7. Ptosis, restricted mobility and enophthalmus are associated only with those cases in which extensive tumorous infiltration of the tissues had taken place.

Gyula Lugossy.

Hertzberg, R. **Proptosis in infancy and childhood: a report of nine cases.** Tr. Ophth. Soc. Australia. **14**:30-39, 1954.

The causes of proptosis in infancy and childhood are enumerated. Nine patients with unilateral proptosis, varying in age from newborn to seven years, are reported. Case histories include neuroblastoma, retrobulbar hemorrhage, hemangioma, hydatid cyst, reactive edema, metastatic abscess, meningeal sarcoma and rhabdomyosarcoma. (6 figures, 13 references) Ronald Lowe.

Kerkenezov, N. **Acute nonspecific infection of the orbit, with a report of three cases.** M. J. Australia **2**:293-295, Aug. 20, 1955.

Three case reports of acute orbital infection stress the importance of the cardinal signs of proptosis, lid edema, chemosis and limitation of ocular movements. In two cases infection spread from the accessory nasal sinuses and in the third case from the skin. (1 figure, 1 reference) Ronald Lowe.

Spaeth, Edmund B. **The treatment of orbital tumours.** Tr. Ophth. Soc. U. Kingdom **74**:297-328, 1954.

In considering the treatment of orbital tumors, one must be aware of three important factors, 1. the histopathology of the neoplasm and its relationship to irradiation therapy, to metastases and to mortality, 2. the effect that the tumor has upon visual acuity and the integrity of the eyeball, and 3. the question of the final postoperative appearance. After a general discussion of the treatment of exophthalmos due to invasion of the orbit, the author deals with each type of neoplasm in detail. (20 figures, 18 references)

Beulah Cushman.

15

EYELIDS, LACRIMAL APPARATUS

Heydenreich, A. **Tarsectomy as an operation for ectropion of the lower lid.** Klin. Monatsbl. f Augenh. **126**:756-759, 1955.

In 1951 Comberg advised the old method of Kugel for treatment of an old or recurrent ectropion. In these cases the tarsus of the lower lid is so degenerated and curved that it should be excised to ensure normal position of the lid. 18 patients were treated in this way with good results. (2 figures, 13 references)

Frederick C. Blodi

Schimek, Robert A. **A new ptosis operation utilizing both levator and frontalis.** A.M.A. Arch. Ophth. **54**:92-99, July, 1955.

A ptosis operation utilizing both levator and frontalis is described. The levator tendon is brought through the tarsal plate and anchored to the frontalis in two separate strips. (6 figures, 7 references)

G. S. Tyner.

Appelmans, M., and Jansen, E. **Bilateral hypertrophy of the tarsus and diffuse Meibomian adenitis.** Bull. Soc. belge d'opht. **108**:619-624, Nov., 1954.

The case history of a 30-year-old man with bilateral hypertrophy of the tarsus and diffuse Meibomitis is presented. The patient was severely handicapped in his work because of the nearly complete ptosis and the severe itching. The biopsy specimen showed infectious granuloma of the Meibomian glands with foreign-body giant cells. Trachoma, vernal catarrh and mycotic, syphilitic, and tuberculous dis-

ease of the tarsus were therefore eliminated in the differential diagnosis. (5 figures, 5 references) Alice R. Deutsch.

Gramberg-Danielsen, B. **A modification of the Friedenwald-Guyton ptosis operation.** Klin. Monatsbl. f. Augenh. **127**:95-96, 1955.

In order to avoid any asymmetry of the suture, the authors begin and finish their suture line in a fifth, additional point which lies 3 to 4 cm. above the middle of the brow. (2 figures, 3 references) Frederick C. Blodi.

Kettesy, A. **Split thickness grafts for defects in lid and face.** Klin. Monatsbl. f. Augenh. **127**:50-58, 1955.

The author was one of the first to use split thickness grafts. Four cases from his clinic in Hungary are described; two patients had burns and two had lupus vulgaris. In the postoperative treatment, ointment, dressing and good protection are important. The author uses a knife to cut the graft and prefers the forearm as a donor site. (10 figures, 5 references) Frederick C. Blodi.

17
INJURIES

Ballantyne, J. F. **Siderosis bulbi.** Brit. J. Ophth. **38**:727-733, Dec., 1954.

The author presents an excellent discussion of the pathologic changes as well as the clinical picture of siderosis found in 20 human eyes enucleated because of intraocular metallic foreign body. The severity of the siderosis noted depended upon: 1. shape, size and corrosive properties of the foreign body, 2. site of the foreign body, and 3. associated trauma and resultant tissue reaction. The size of the foreign body determines the area available for oxidation. Iron and carbon steel offer little resistance to corrosion and oxidation in contrast to alloyed and nonmagnetic steel. The latter causes siderosis only rarely. Oxidation is rapid if the foreign body is bathed in ocular fluids and slow when it lies in tissues of low metabolism such as the cornea or lens. Rupture of the lens capsule or Bruch's membrane expedites dispersion of iron. (7 figures, 9 references) Laurence L. Garner.

Gourlay, J. Stewart. **Mercurialentis.** Tr. Ophth. Soc. U. Kingdom. **74**:441-447, 1954.

Mercury is used by mirror workers, in the felt hat industry, in the thermometer industry, meter repairers, manufacturers of caustic soda, and by policemen in taking finger prints. Salivation, tremors and psychological aberration known as erethism are early indications of chronic mercury poisoning.

Six out of 50 workers showed the discoloration of the anterior lens capsule described by Atkinson, but the vision was unaffected (2 tables, 13 references) Beulah Cushman.

Hartmann, Karl. **Corneal injury by tear gas.** Klin. Monatsbl. f. Augenh. **126**:760-762, 1955.

This is an addition to the author's first article on the same subject (Klin. Monatsbl. f. Augenh. 125:475, 1954). The author has heard of five more cases of corneal damage caused by tear gas shot out of a pistol at close range. A deep keratitis develops characteristically as a late complication. Small, yellowish foreign bodies may be found in the cornea. (7 references) Frederick C. Blodi.

Krannig, Hans-Dieter. **Injury of the sclera and posterior stellate cataract after a bee sting.** Klin. Monatsbl. f. Augenh. **126**:750-753, 1955.

A bee sting when it perforates the globe usually is in the cornea. In this instance, however, the sclera was perforated. A

traumatic (or toxic) mydriasis followed. Unusual were the lens opacities which could be detected ten days after the injury. They assumed the form of a traumatic late rosette. (1 figure, 25 references)
Frederick C. Blodi.

Zauleck, C. **Corneal damage by tear gas.** Klin. Monatsbl. f. Augenh. **126**:740-742, 1955.

This is an addition to Hartmann's paper on the same subject (Klin. Monatsbl. f. Augenh. 125:475, 1954). Seven more patients are reported. Tear gas may cause deep corneal opacities a few days after the injury. In addition, the explosion when shot at close range from a gas pistol may injure the eye directly. (14 references)
Frederick C. Blodi.

Hartmann, Karl. **Corneal damage with Rhizoma galangae.** Klin. Monatsbl. f. Augenh. **127**:97-99, 1955.

Rhizoma galangae is an aromatic spice closely related to ginger. It contains galangal, a pungent resine. A temporary deep keratitis with iritis developed in a 54-year-old druggist into whose eye this spice had inadvertently been splashed.
Frederick C. Blodi.

Miller, S. J. H. **Ocular ochronosis (hydroquinone—its properties and uses)** Tr. Ophth. Soc. U. Kingdom **74**:349-366, 1954.

A characterisic feature of the effect on the eye of hydroquinone, an ingredient of a photographic developer, is the staining of the eye within the palpebral fissure, which suggests that exposure to light in some way promotes deposition of pigment. The cornea develops a sepia-like stain which gradually becomes so dense as to impede vision seriously. Vertical folds may appear in Descemet's membrane and the whole structure of the cornea may become deformed and give rise to an irregular and progressive astigmatism. The disturbance may begin as an eccentric keratoconus and progress to an ulceration complicated by vascularization. The earliest conjunctival change is a thickening and drying in the area of a pinguecula, beginning as a light yellow stain and changing to brown; the patches vary in size, shape and density. The length of exposure is the main determining factor in producing damage and older workers are more prone to ocular complications than the young.
Beulah Cushman.

Redmond, K. B. **Eye injuries in western New South Wales.** Tr. Ophth. Soc. Australia **14**:102-116, 1954.

Of 6,953 patients presenting themselves for ocular examination from 1952 to 1954, 666 (9.5 percent) came because of some injury to the eye. These are analyzed as to geographical area, sex and age, industrial and domestic status, minor and major injuries, perforations, intraocular foreign bodies, fractured skulls and other injuries, and blindness. The commonest causes of perforating injuries were wire recoil and scissors. The paper contains 15 tables and much detailed information. (16 tables, 5 references) Ronald Lowe.

18

SYSTEMIC DISEASE AND PARASITES

Carli, J., and Huraux, C. **The ocular fundus in primary tuberculosis among adolescents.** Ann. d'ocul. **188**:344-363, April, 1955.

Fundus lesions attributable to tuberculosis were found in 20 (12.5 percent) of 150 young men between the ages of 16 and 22 years, affected with the primary form of the disease. Fourteen of the 20 patients showed one to three choroidal granulomas in one or both eyes. Chorioretinitis was found in three cases, choroidal granuloma plus chorioretinitis

in one, tuberculomata in one, and papillitis in one.

In no case was the presence of choroidal granulomas associated with an unfavorable course, but in three out of six severe cases the other types of fundus lesions (chorioretinitis, tuberculoma, papillitis) were found, so that when these are met with, a guarded prognosis is indicated. (3 tables, 16 references) John C. Locke.

Piantoni, G. H., and Aguinaga, F. **Ophthalmic geriatrics.** Arch. oftal. Buenos Aires **30**:19-40, Jan., 1955.

This is a thorough review of such lesions as appear in the eye and its adnexa as a direct result of, or in connection with, the process of aging.

A. Urrets-Zavalia, Jr.

Budden, F. H. **Incidence of human infection with onchocerciasis in different communities in relation to the incidence and types of the ocular lesions.** Brit. J. Ophth. **39**:321-332, June, 1955.

Four types of onchocercal lesions are considered in the diagnosis of ocular onchocerciasis: 1. keratitis involving area of pupil, 2. iridocyclitis, 3. optic atrophy without choroidoretinal lesions, and 4. choroidoretinal lesions.

The occurrence of onchocercal choroidoretinal lesions appears to be related to the presence of the infection rather than to its intensity, whereas the incidence of onchocercal iridocyclitis, keratitis and optic atrophy seems to be directly related to the intensity of the human infection. The concentration of microfilariae per field noted in the skin snips taken from the area of the iliac crests is used to determine the intensity of the infection. In areas where the infection rate is highest illness occurs at an early age (10 years) while in areas where the infection rate is low, it begins later in life. (2 figures, 3 tables, 8 references)

Lawrence L. Garner.

Landesman, Robert. **Retinal and conjunctival vascular changes in normal and toxemic pregnancy.** New York Acad. Med. Bull. **31**:376-390, May, 1955.

Six cases are presented to illustrate the author's extensive study of vascular changes in the bulbar conjunctiva and retina during normal and abnormal pregnancies. In the bulbar conjunctiva he has noted that mild spasm in the last trimester, during labor, and in the first week postpartum is normal. Moderate spasm in the first trimester is indicative of hypertensive disease. More than mild spasm, such as Grade II or over in the last trimester is not normal and indicates toxemia. Similarly Grade II retinal changes are very serious if associated with albuminuria and severe hypertension. In such cases fetal death may be anticipated in an average of three weeks after the appearance of these associated findings. (7 figures, 1 chart, 34 references)

Harry Horwich.

Meadows, S. P. **Temporal arteritis and loss of vision.** Tr. Ophth. Soc. U. Kingdom **74**:13-24, 1954.

Meadows describes the clinical manifestations of temporal arteritis. Ocular disturbances occur in 40 percent of cases. Loss of vision occurs in one or both eyes in 25 percent of cases and seems proportionate to the visible changes in the fundus of the eye. Transient diplopia is an occasional feature. The author presents the clinical record of 12 patients. Differential diagnosis must include retrobulbar neuritis. (4 figures, 14 references)

Beulah Cushman.

19

CONGENITAL DEFORMITIES, HEREDITY

Campbell-Orr, H. **Assessment of visual incapacity following industrial injury.** Tr. Ophth. Soc. U. Kingdom **74**:367-375, 1954.

The author reviews the need for utmost

care in examining claimants for visual loss in industry. Each case requires careful examination of visual acuity, quality of vision, the field of vision, and the state of binocular vision. He recommends that the assessor visit the coal mines or plants and see or try the different kinds of work in which the men are engaged. (2 tables, 7 references) Beulah Cushman.

François, J., and Neetens, A. **Hydrophthalmos with microcornea and other hereditary anomalies.** Bull. Soc. belge d'opht. 108:553-573, Nov., 1954.

The simultaneous occurrence of microcornea and hydrophthalmos is rare indeed. Considerable research work concerning the pathogenesis and differential diagnosis of cornea plana and microcornea with and without additional changes in the anterior and posterior segments of the eyeballs are reported. Case histories of two brothers are discussed in detail. The younger brother had a bilateral hydrophthalmos with a microcornea pseudoplana, a small mandible, arterial hypertension, diabetes and diffuse intracranial calcification. He was of a stocky build. His E.E.G. was abnormal and he showed signs of a pseudoextrapyramidal lesion. His brother had a monocular hydrophthalmos and his eye had to be removed when he was seven years old. He had the same stocky appearance, a micrognathia and presented similar neurological lesions. He also had diabetes and hypertension. The mother and grandmother of these patients had diabetes and showed identical trembling of the head and extremities. Heredity of these malformations was considered to be dominant and polyphenic. (11 figures, 55 figures.) Alice R. Deutsch.

de Silva, C. C. **Tay-Sachs disease in two Sinhalese children.** Brit. M. J. 768-770, Sept. 24, 1955.

Cerebromacular degeneration of the Tay-Sachs type in two Sinhalese children is described. The disease was characterized by mental retardation, myoclonic fits and the characteristic fundus picture with optic atrophy. In one child the first manifestations were noted at the age of two months and the child died two years and eight months later; the two-year-old child died two months after the disease began. Histologic findings were the usual ones except that there were large calcifying hyaline masses in the brain substance and the pia arachnoid. (10 references)

Irwin E. Gaynon.

von Szily, A. **Morphography and phenogenetics of the papilla of the optic nerve.** Klin. Monatsbl. f. Augenh. 126: 641-669, 1955.

This is a compilation of some papers left by the late professor of ophthalmology in Münster. In the first part colobomas of the optic disc are discussed. The incomplete forms are especially emphasized. Among those are: enlargement of the entire disc, enlargement of the disc downward and pits in the papilla. The second part deals with anomalies of the optic disc associated with choroidal colobomas. The appearance of the disc may vary a great deal and may run the gamut from normal papilla to total coloboma. The disc may also show a conus, either a regular, temporal one or an inferior one. The various forms of choroidal coloboma are presented. Bridge-coloboma and minimal coloboma are discussed. The occurrence of other anomalies in the same eye (retinal cysts) may be of great importance. (11 figures)

Frederick C. Blodi.

Timm, Gisela. **Seven cases of bilateral, hereditary lens luxation.** Klin. Monatsbl. f. Augenh. 126:743-750, 1955.

These seven patients belong to three families. In four patients the ocular lesions were uncomplicated by systemic

anomalies. One patient displayed the Marfan syndrome and two siblings the Marchesani (spherophakia, small stature) type. (8 figures, 1 table, 12 references)

Frederick C. Blodi.

Tulloh, C. G. **Hereditary posterior polar cataract with report of a pedigree.** Brit. J. Ophth. **39**:374-379, June, 1955.

A unique type of hereditary, developmental, posterior polar cataract of a progressive nature is described, with the report of a pedigree. The observations are carried into the fifth generation and reveal a visual loss beginning in adult life until the third generation. In the fourth generation visual loss is noted at about puberty while in the fifth generation the visual loss began during childhood. (5 figures, 2 references)

Lawrence L. Garner.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Campbell, Dorothy A. **The changes in the incidence of the eye affections of coal miners in the past twenty-five years.** Tr. Ophth. Soc. U. Kingdom **74**:79-93, 1954.

The incidence of nystagmus in miner's diseases is reported by the author after a period of 25 years when the Research Council made a full investigation of the disease. This report establishes from historical evidence and photometric tests that the dominant causative factor was deficient illumination. In 1939 the Society agreed that the disease was largely a neurosis and that the cases should not be certified unless definite oscillations of the eyes could be detected. The latest figures show that about one percent of underground miners have Miner's nystagmus. Miner's nystagmus is regarded as a disturbance of the ocular-sensory-motor impulses whereby the normal physiologic high frequency rate is converted to a pathologic one of lower rate. Decline of the disease is obvious but differentiation should be found between "true" nystagmus and "psychoneurosis without oscillations." The impression continues that when economic conditions are bad, the incidence of Miner's nystagmus increases. (8 figures, 1 table, 11 references)

Beulah Cushman.

Clifton, Frank. **The assessment of eye injuries in industry.** Tr. Ophth. Soc. U. Kingdom **74**:519-522, 1954.

The author considers the social, psychological and economic factors in industrial injury of eyes and he feels that they cannot be transcribed mathematically. (6 references) Beulah Cushman.

Doggart, J. H. **Retrospective diagnosis.** Tr. Ophth. Soc. Australia **14**:92-101, 1954.

An interesting account is given of some of the devastating epidemics of history, the illnesses or peculiarities of many famous people, or disease conditions that may have been diagnosed only later when more knowledge was available.

Ronald Lowe.

Freeman, Eugene. **Morality and professionalism.** Am. J. Optometry **32**:487-494, Sept., 1955.

The professional man will put the patient's welfare above his own. For instance, it is unprofessional to continue exercises after improvement has ceased. Naturally, in case of doubt, the doctor is prejudiced in favor of procedures providing income and must constantly be on guard against this prejudice.

Paul W. Miles.

NEWS ITEMS

Edited by Donald J. Lyle, M.D.
601 Union Trust Building, Cincinnati 2

News items should reach the editor by the 12th of the month but, to receive adequate publicity, notices of postgraduate courses, meetings, and so forth should be received at least three months before the date of occurrence.

Deaths

Dr. A. Milton Goldman, Rockville Center, New York, died August 26, 1955, aged 62 years.

Dr. Herbert Clarence Neblett, Charlotte, North Carolina, died August 21, 1955, aged 67 years.

Dr. Roderic Patrick O'Connor, Oakland, California, died July 6, 1955, aged 77 years.

Dr. James Ross Reed, Altadena, California, died May 11, 1955, aged 75 years.

Dr. William Humes Roberts, La Jolla, California, died September 18, 1955, aged 83 years.

Announcements

Research Study Club

The 25th annual midwinter clinical convention in ophthalmology and otolaryngology of the Research Study Club of Los Angeles will be held January 16 through January 27, 1956. The guest lecturers for the eye program will be Dr. F. Bruce Fralick, University of Michigan, Ann Arbor; Dr. Harold F. Falls, University of Michigan, Ann Arbor; Dr. David O. Harrington, University of California, Berkeley.

Instruction courses in ophthalmology will be presented by Dr. Harrington on flicker-fusion perimetry; Dr. Homer E. Smith of Salt Lake City, on anterior chamber hemorrhages; Dr. James N. Greear, Jr., of Reno, Nevada, on intraocular tumors; Dr. Max Fine of San Francisco, on keratoplasty; and Dr. W. C. Cameron of Tacoma, on cataract surgery. The week of Monday, January 23rd, to Friday, January 27th, is devoted to ophthalmology.

Each applicant must be a member in good standing of the American Medical Association in order to become eligible for attendance at the convention. The fee for the entire two weeks or any part of it is $100.00 and includes the cost of all luncheons. For further information write:

Dr. Norman Jesberg
500 South Lucas Avenue
Los Angeles 17, California

New Orleans Academy

Guest speakers at the sixth annual session of the New Orleans Academy of Ophthalmology, January 3 to 6, 1956, will be: Dr. Frederick C. Cordes, San Francisco; Dr. Derrick Vail, Chicago; Dr. John Dunnington, New York; Dr. S. Rodman Irvine, Los Angeles; Dr. Harvey Thorpe, Pittsburgh; Dr. Paul Chandler, Boston; and Dr. V. Everett Kinsey, Detroit.

Survey of Ophthalmology

A new review journal, *The Survey of Ophthalmology*, will begin publication in February, 1956. Frank W. Newell, Professor of Ophthalmology at the University of Chicago, is editor and Williams and Wilkins Company of Baltimore are the publishers. The journal will sift, condense, and comment on the world ophthalmic literature together with presenting review articles. Advisory editors are William L. Benedict, William B. Clark, F. Herbert Haessler, Peter C. Kronfeld, Algernon B. Reese, Phillips Thygeson, and Derrick Vail. Contributing editors are Henry F. Allen, Bernard Becker, Alson E. Braley, Hermann M. Burian, Harold F. Falls, George M. Haik, John W. Henderson, John Woodworth Henderson, Bertha Klien, James E. Lebensohn, Albert N. Lemoine, Jr., Irving H. Leopold, Otto Lowenstein, P. Robb McDonald, Austin Riesen, Theodore E. Sanders, David Schoch, Daniel Snydacker, H. Saul Sugar, Edwin F. Tait, Gordon L. Walls, and Arthur Linksz.

The Survey of Ophthalmology will appear bimonthly in the months of February, April, June, August, October, and December. The subscription is nine dollars annually.

V Congress of Pan-American Medical Women's Alliance

The V Congress of the Pan-American Medical Women's Alliance will be held in Santiago and Vina del Mar, Chile, March 6 to 14, 1956. Opportunities for sightseeing and visits to medical programs in Mexico, Salvador, Panama, Chile, Bolivia, and Peru have been arranged.

Information may be obtained from the secretary:

Dr. Eva F. Dodge
2124 West 11th Street
Little Rock, Arkansas

Or from the program chairman:
Dr. Eva Cutright
Wooster, Ohio.

Human Genetics Congress

The first International Congress of Human Genetics will be held in Copenhagen, Denmark, August 1 to 6, 1956. Some of the program will be devoted to genetics and ophthalmology. Full information may be obtained from:

The First International Congress
of Human Genetics
14, Tagensvej
Copenhagen, N., Denmark

Miscellaneous

Lecturers at Institutes of Health

Prof. Ernst H. Bárány of the University of Upsala, Sweden, presented a lecture on December 8, 1955, at the National Institutes of Health, Bethesda, Maryland. As guest of the Ophthalmology Branch, National Institute of Neurological Diseases and Blindness, Professor Bárány spoke on "Factors controlling the resistance to flow through the chamber angle."

Societies

Milwaukee officers

Newly elected officers of the Milwaukee Oto-Ophthalmic Society are: President, Dr. Donald T. Hughson; vice-president, Dr. Howard V. Morter; secretary, Dr. E. Franklin Carl.

United Kingdom society

The annual congress of the Ophthalmological Society of the United Kingdom will be held at the Royal Society of Medicine, 1 Wimpole Street, London, W.1, on April 26, 27, and 28, 1956. The subject for discussion will be "The early diagnosis of glaucoma." There will also be a short symposium on "Herpetic infections of the outer eye." Further information may be obtained from The Ophthalmological Society of the United Kingdom, 45 Lincoln's Inn Fields, London W.C.2.

Personals

Mr. F. W. Law, has been appointed a Knight in the Order of St. John of Jerusalem by Her Majesty, Queen Elizabeth II.

Lady Phyllis Duke-Elder, London, became a Commander in the Order of St. John of Jerusalem by sanction of Her Majesty, Queen Elizabeth II.

Wills Hospital conference

The VIII Annual Clinical Conference of the Staff and Wills Eye Hospital Ex-Resident Society will be held at the hospital on February 17 and 18, 1956. The Bedell Lecture will be delivered by Dr. A. D. Ruedemann of Detroit, on the subject of "Progressive bilateral exophthalmos: Differential diagnosis and treatment."

The program will also include scientific papers by members of the staff and ex-residents of the hospital, technical exhibits, and a color television program sponsored by Smith, Kline and French Laboratories which will present ocular surgery, case presentations, and demonstrations of procedures and techniques.

On Friday evening, February 17, there will be an informal reception and supper for the ophthalmologists and their wives. On completion of the two-day program, the Wills Eye Hospital Ex-Resident Society will hold its annual meeting and dinner at the Union League, Philadelphia, on Saturday, February 18, 1956, at 6:30 P.M.

Stanford postgraduate conference

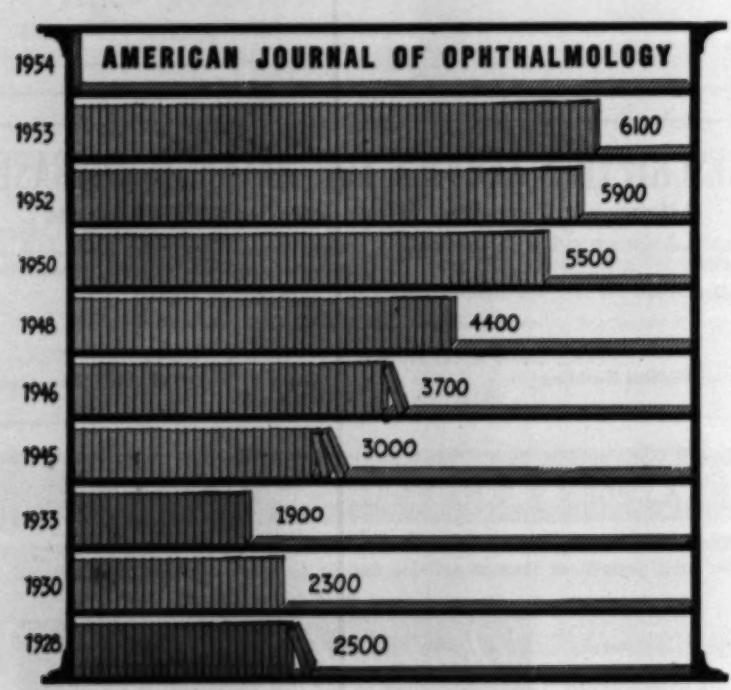
Stanford University School of Medicine will present the annual postgraduate conference in ophthalmology from March 19 through March 23, 1956. Registration will be open to physicians who limit their practice to the treatment of diseases of the eye; or eye, ear, nose and throat. In order to allow free discussion by members of the conference, registration will be limited to 30 physicians.

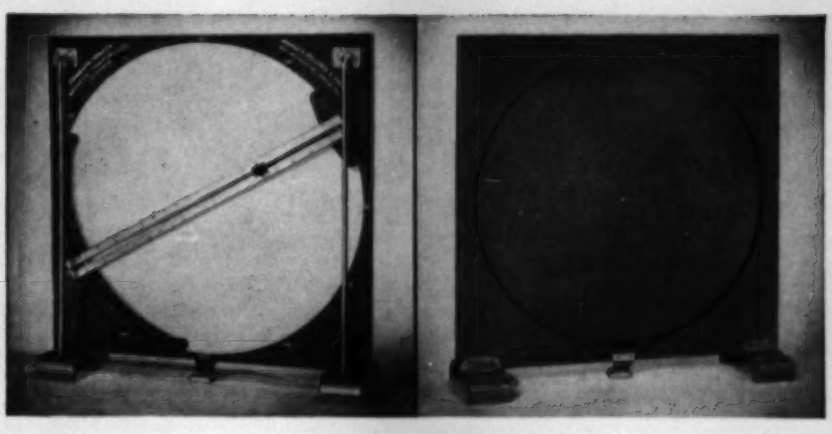
Instructors will be Dr. David L. Bassett, Dr. Jerome W. Bettman, Dr. Max Fine, Dr. Earle H. McBain, Dr. Arthur J. Jampolsky, and Dr. Dohrmann K. Pischel.

Programs and further information may be obtained from the Office of the Dean, Stanford University School of Medicine, 2398 Sacramento Street, San Francisco 15, California.

PRESCRIPTION OPTICIANS

The Sixth Annual Meeting of the New Orleans Academy of Ophthalmology will be held in New Orleans, Roosevelt Hotel, January 3-6, featuring "Diseases and Surgery of the Lens". The registration fee of $75.00 includes membership in the Academy for the year 1956. Hotel reservations should be made early by writing to the Roosevelt or 211 S. Saratoga St., New Orleans, La.





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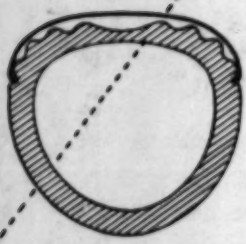

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